(19) Europäisches Patentamt
European Patent Office
Office européen des br v ts

(11) Publication number: **0 320 745**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88120314.5**

(51) Int. Cl.4: **E04B 2/72 , E04B 1/00**

(22) Date of filing: **06.12.88**

(30) Priority: **11.12.87 US 132087**

(43) Date of publication of application:
21.06.89 Bulletin 89/25

(84) Designated Contracting States:
BE CH DE ES FR GB IT LI NL SE

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(54) Modular building structure and prefabricated components therefor and related methods.

(57) The invention describes modular building (10) structures that can be constructed with a plurality of prefabricated structural components (30,35,16,18,31,19). The modular building structure can be erected in a relatively short time without the need for craftsmen skilled in the building trades and without the need for specialized tools.

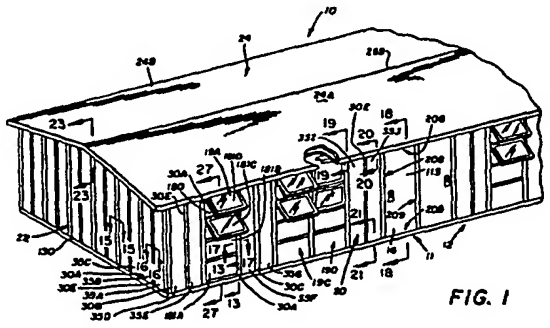

FIG. 1

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MODULAR BUILDING STRUCTURE AND PREFABRICATED COMPONENTS THEREFOR AND RELATED METHODS

TECHNICAL FIELD

The present invention relates generally to modular building structures. More particularly, the present invention relates to modular building structures that can be constructed with a plurality of prefabricated structural components. Specifically, the present invention relates to a modular building structure that can be constructed from preformed structural components and erected by virtue of a novel method in a relatively short time without the need for craftsmen skilled in the building trades.

BACKGROUND OF THE INVENTION

It is well known in the construction industry that significant economic savings can be realized by reducing the amount of work required at the construction site. To achieve this objective, prefabrication has been adopted on a large scale in the construction industry both with respect to general purpose buildings and with respect to personal housing. For example, some sources have estimated that as many as forty percent (40%) of the homes now being built use some form of premanufactured structural components. In general terms, the basic approach has been to produce, at a remote site and in a factory environment, as many of the components of the given building as possible, leaving only site preparation and final assembly to be done at the actual construction site.

There are a number of advantages to be achieved by prefabrication. The most obvious of those advantages is the significant reduction of time and labor required at the job site where labor costs are normally the highest. In addition to the reduced time required for actual erection of the building, there are other time savings possible, particularly inasmuch as the reduced amount of work time at the job site reduces the potential for interruptions resulting from inclement weather.

Furthermore, increased uniformity of the structural components resulting from the enhanced quality control possible in a controlled factory atmosphere and the economic advantages of mass production techniques are also achievable with the prefabrication approach. As is often the situation, the use of standardized, prefabricated structural components not only improves the uniformity of the end product but also greatly simplifies the actual erection process. This last feature also makes it possible to produce quality buildings with unskilled, or minimally skilled, personnel. Thus, the overall results of prefabrication in the construction industry are greatly improved efficiency and significantly reduced costs.

These advantages are, of course, desirable in any type of construction, but are believed to be exceptionally promising in the production of individual dwellings, particularly in economically distressed areas where cost is one of the most significant obstacles to overcome.

There are a wide variety of practical ways of effectuating the prefabrication concept.

For example, the Crowe U.S. Patent, No. 1,998,448, discloses the factory prefabrication of steel frame panel units of standard dimensions which are filled with cementitious material and assembled so as to leave vertical spaces between adjacent vertical walls for utility connection and with laterally adjacent panels being joined by cover strips or slabs which are interconnected thereto.

The Wagner U.S. Patent, No. 2,850,771, discloses a prefabricated construction system wherein wooden panels are interconnected to vertical posts or columns with the vertical edges of the wooden wall panels and the posts having grooved areas and with spline blocks being used to interconnect the two.

The Paul U.S. Patent, No. 3,229,431, is indicative of another approach wherein a so-called "frameless" modular multistory building is constructed from self-contained prefabricated modules which are simply set on a building foundation and attached thereto by anchor bolts set in the foundation.

The Bolt U.S. Patent, No. 3,284,966, is of general interest in showing a prefabricated building which can be readily assembled or erected at the job site and which is collapsible for transportation purposes.

The Moore U.S. Patent, No. 3,783,563, discloses a prefabricated building constructed of panels formed of molded plastic material, reinforced with glass fibers, and wherein the panels have channels or ribs on their edges adapted to mate with complementary structures of connector members.

Other examples of prefabricated construction components utilizing various plastic materials can be seen in the Kennedy U.S. Patent, No. 2,918,151; the Espeland U.S. Patent, No. 3,662,507; the Sohns U.S. Patent, No. 3,397,496; and, the Farge U.S. Patent, No. 4,183,185.

The foregoing patents are believed to be generally representative of the prior art represented by U.S. patents, and that art does illustrate some diverse approaches to the pr fabrication of buildings using various materials. However, none of the aforesaid prior art patents, nor any other prior art with which the inventors are aware, either alone or in combination, achieve the several objects of the present invention.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide an improved building structure which can be constructed, virtually in its entirety, from a plurality of standardized, mass produced, structural components.

It is another object of the present invention to provide a building structure, as above, which can be erected by relatively unskilled laborers without specialized tools.

It is still another object of the present invention to provide a building structure, as above, which can be erected in a far shorter period of time than a comparable structure constructed from prior known structural components.

It is yet another object of the present invention to provide unique structural components which can be mass produced at relatively modest expense and can then be conveniently shipped to a remote construction site, also at relatively modest cost.

It is a further object of the present invention to provide unique structural components, as above, which are designed to be conveniently extruded from a high performance thermoplastic resin, preferably fiber reinforced, which will equal or exceed the performance characteristics of components made from conventional building materials and which are of relatively light weight for ease of handling.

It is an even further object of the present invention to provide structural components in the nature of coupler members for interconnecting certain other structural components such as, for example, panel members and jamb members.

It is yet a further object of the present invention to provide structural components, as above, which are of sufficiently unique design as to permit quick and facile interconnection by virtue, for example, of means which comprise at least a first pair of connecting flanges presented from each of the coupler members and at least one pair of locking grooves presented from each of the other structural components for effecting a sliding, or telescoping, interconnection therebetween.

It is a still further object of the present invention to provide structural components in the nature of primary coupler members having a hollow body portion and one or more additional pairs of connecting flanges extending in planes perpendicular to at least the first pair of locking flanges for interconnection with additional structural components that are disposed in planes perpen dicular to the plane of the said first pair of connecting flanges.

It is another object of the present invention to provide structural components in the nature of secondary coupler members having a web portion and two pairs of connecting flanges extending outwardly from the web in diametrically opposite directions and adapted for interconnection with locking grooves in certain other structural components.

It is an even further object of the present invention to provide structural components in the nature of window/door jamb members having means on at least one vertical edge surface for effecting interlocking interconnection with adjacent coupler members.

It is an additional object of the present invention to provide structural components in the nature of closure frames having suitably configured, peripheral recesses for engagement with the window/door jamb members.

These and other objects of the invention, as well as the advantages thereof over existing and prior art forms, which will be apparent in view of the following detailed specification, are accomplished by means hereinafter described and claimed.

In general, a modular building structure embodying the concepts of the present invention is erected on a supporting base. The supporting base delineates the locus of points which define the horizontal location of at least the exterior, and preferably also the interior, walls of the modular building structure. A plurality of load bearing coupler members are disposed at intervals along the aforesaid locus of points, and the coupler members are oriented substantially vertically with respect to the supporting base. Means are provided to secure at least selective of the coupler members to the supporting base.

A plurality of panel members are interposed between the successively spaced coupler members, and means are provided structurally to tie the panel members to the coupler members.

In addition to the panel members and the coupler members, a plurality of supplemental structural components are provided to accommodate th selective construction, placement, and operation, of doors and windows as well as to facilitat the support and joinder of juxtaposed components forming the roof of the modular building structure.

One exemplary building structure and at least

on exemplary form of each structural component, together with appropriate modifications thereof when deemed desirable to effect a full disclosure of the subject invention, are shown by way of example in the accompanying drawings and are described in detail without attempting to show all of the various forms and modifications in which the inven tion might be embodied; the invention being measured by the appended claims and not by the details of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a modular building structure embodying the concepts of the present invention, said building structure representing one complete housing unit and a portion of a contiguous housing unit, as may be incorporated within a successive series of such housing units, each of which share a common divider wall with any immediately adjacent unit;

FIG. 2 is a floor plan for one typical housing unit included within the representative building structure depicted in FIG. 1;

FIG. 3 is a perspective representation of a structural component in the nature of an exemplary panel member employed in the walls and roof of a modular building structure such as depicted in FIG. 1;

FIG. 4 is a perspective representation of a structural component in the nature of an exemplary primary coupler member that is particularly adapted to be interposed, and thereby to effect a structural tie, between two, successive, linearly oriented, structural components of the type adapted to be interconnected by said coupler members;

FIG. 5 is a perspective representation of another structural component in the nature of an alternative form of a primary coupler member that is particularly adapted to be interposed, and thereby to effect a structural tie, between two, successive, structural components (of the type adapted to be interconnected by said coupler members) that are perpendicularly disposed, one with respect to the other;

FIG. 6 is a perspective representation of yet another structural component in the nature of a further alternative form of a primary coupler member that is particularly adapted to be interposed at the juncture of three structural components (of the type adapted to be interconnected by said coupler members) and thereby to effect a structural tie between the three said structural components, two of which are linearly oriented, one with respect to the other, and the third of which is perpendicularly oriented with respect to the other two;

FIG. 7 is a perspective representation of still another structural component in the nature of an even further, alternative, primary coupler member that is particularly adapted to be interposed at the juncture of four structural components (of the type adapted to be interconnected by said coupler members) and thereby to effect a structural tie between the four said structural components which are arranged in two pairs, each pair being linearly oriented with respect to each other and perpendicularly oriented with respect to the structural components forming the other pair;

FIG. 8 is a perspective representation of a structural component in the nature of an exemplary secondary coupler member that is particularly adapted to be interposed, and thereby to effect a structural tie, between two, successive, linearly oriented, structural components of the type adapted to be interconnected by said coupler members;

FIG. 9 is a perspective representation of a structural component in the nature of an exemplary jamb member;

FIG. 10 is an exploded perspective representation of a further structural component, this structural component being in the nature of a closure frame member and a separate, juxtaposed, glazing bead member which may be selectively secured to the closure frame;

FIG. 11 is a perspective representation depicting the corner intersection of two form members employed to delineate at least the outer periphery of one type of a supporting base upon which the modular building structure depicted in FIG. 1 may be erected;

FIG. 12 is a perspective representation depicting a portion of an alternative form member employed to delineate at least the outer periphery of another type of supporting base upon which the modular building structure depicted in FIG. 1 may be erected;

FIG. 13 is an enlarged, vertical section taken substantially along line 13- 13 of FIG. 1 depicting the structural details of one form of a sill plate that is interposed between the exterior walls and that embodiment of the supporting base the periphery of which was defined by the form member depicted in FIG. 11;

FIG. 14 is a vertical section similar to FIG. 13, but depicting the structural details of an alternative, and further representative, form of a sill plate that is interposed between the exterior walls and that embodiment of the supporting base the periphery of which was defined by the form member depicted in FIG. 12;

FIG. 15 is an enlarged, horizontal section taken substantially along line 15- 15 of FIG. 1 depicting the details of a representative arrange-

ment by which to conjoin one or more panel members (FIG. 3) to a primary coupler member of the type depicted in FIG. 4;

FIG. 16 is an enlarged, horizontal section taken substantially along line 16- 16 of FIG. 1 depicting the details of a representative arrangement by which to conjoin two succ ssive panel members (FIG. 3) to a secondary coupler member of the type depicted in FIG. 8;

FIG. 17 is an enlarged, horizontal section taken substantially along line 17- 17 of FIG. 1 depicting not only the details of a representative arrangement by which to conjoin a jamb member (FIG. 9) to a primary coupler member of the type depicted in FIG. 4 but also the details of the structural relationship between an operatively conjoined closure frame member, including an appropriate glazing bead (both as depicted in FIG. 10) and the said jamb member;

FIG. 18 is an enlarged, vertical section taken substantially along line 18- 18 of FIG. 1 depicting one type of operative interrelationship between a door and the jamb members employed at the top and at the threshold of a door opening;

FIG. 19 is an enlarged, vertical section taken substantially along line 19-19 of FIG. 1 depicting a typically representative arrangement by which to support a roof to an exterior wall in a modular building structure embodying the concepts of the present invention;

FIG. 20 is an enlarged, vertical section taken substantially along line 20-20 of FIG. 1 depicting an alternative arrangement by which to support a roof to an exterior wall;

FIG. 21 is an enlarged, vertical section, similar to FIGS. 13 and 14, but taken substantially along line 21-21 of FIG. 1 to depict the structural details of yet another representative, and perhaps preferred, form of a sill plate that may be interposed between the exterior, and even the interior, walls and virtually any variation of a supporting base;

FIG. 22 is an enlarged, vertical section, similar to FIGS. 19 and 20, but depicting the details of yet another representative, and perhaps preferred, arrangement by which to support, and secure, a roof to an exterior wall in a modular building structure of the type depicted in FIG. 1;

FIG. 23 is an enlarged, vertical section taken substantially along line 23-23 of FIG. 1 depicting the details of one arrangement by which to support, and finish, the ridge of a building embodying the concepts of the present invention;

FIG. 24 is a perspective depicting the structural details of one means by which to support the ridge from a primary coupler member incorporated in the end wall of a building structure of the type depicted in FIG. 1;

FIG. 25 is an exploded perspective depicting a representative arrangement by which to support a purlin interposed at a selected location along the span of the roof;

FIG. 26 is a vertical section taken substantially along line 26-26 of FIG. 25 and appearing on the same sheet of drawings as FIG. 24;

FIG. 27 is an enlarged, vertical section taken substantially along line 27-27 of FIG. 1 to represent the interrelation between a plurality of stacked window units fabricated from structural components according to the concepts of the present invention; and,

FIG. 28 is a representative perspective of a typical panel member with one lateral edge being tied to one form of a primary coupler member and with the other lateral edge being tied to a secondary coupler member, the opposite, longitudinal ends of said structural components having been recessed such that one end of the depicted assemblage will conform with the cross sectional profile of a selected sill plate and such that the other end will afford a race for electrical wiring, or the like and appearing on the same sheet of drawings as FIG. 25.

DESCRIPTION OF AN EXEMPLARY EMBODIMENT

One representative form of a modular building structure embodying the concepts of the present invention is designated generally by the numeral 10 on the accompanying drawings. The representative building structure 10 may, for example, be employed to serve as residential living quarters. The living quarters may be individual, free standing living units, or the living quarters may comprise a successive series of living units, much in the style of the "town house," or "twinplex," concepts having a common wall which separates adjacent living units. With particular reference to FIG. 1, the structure depicted therein includes one complete living unit 11 which may be integrally juxtaposed with a successively adjacent living unit 12 that is only partially depicted.

With additional reference to FIG. 2 it will be seen that the living unit 11 may include two bedrooms 13A and 13B, a bathroom I4 and a combined eating and living room area 15.

Front and rear doors 16 and 18, respectively, allow ingress and egress from the combined eating and living room area 15, and a plurality of windows 19 can be appropriately located to admit light and/or to permit th selective circulation of air.

In the description which follows a "suffix convention" has been employed. That is, a particular

structural arrangement may be employed at one or more locations. In addition, several variations of a structural component may be presented. When referring generally to a common structural arrangement or variations of a structural component that arrangement, or that component, shall be designated by virtue of a letter suffix employed in combination with the numerical designation employed for general identification of that structural arrangement or that structural component. This same suffix convention shall be employed throughout the specification, and in that regard the suffix convention will be employed, for example, with the windows 19, the load bearing coupler members 30, the positioning shoulders 41 and 42, the connecting flanges 70, the the sill plates 140, the jamb surfaces 168, the stop surfaces 169, the window units 181 and the wall cap assemblies 200.

Because the dimensions of a building constructed in accordance with the concepts of the present invention are modular, as will hereinafter become more fully apparent, a veritable host of individual, living unit floor plans can be incorporated within a building structure embodying the concepts of the present invention. Thus it must be appreciated that the floor plan depicted in FIG. 2 is merely representative.

The representative living unit 11 has an exterior wall 20 which constitutes the front facade, an exterior wall 21 which constitutes the rear facade, an exterior wall 22 which constitutes the exposed, end facade, and a common wall 23 which serves to separate the successively adjacent living units 11 and 12. It should be understood that if living unit 11 were to be an individual, free standing structure, the wall 23 would, in that situation, also constitute an exposed, end facade. The entire living unit 11 is covered by a roof 24 (FIG. 1) which may, as depicted, continue longitudinally of the building structure 10 to cover the living unit 12, as well.

As depicted, a window 19A may be provided in the exterior wall 20 to serve bedroom 13A, and a similar window 19B may be provided in the exterior wall 21 to serve bedroom 13B. In addition, a pair of windows 19C and 19D may be provided in the exterior wall 20 to serve the combined eating and living area 15, and an optional window 19E may be provided in the exterior wall 21 to serve the bathroom 14. The front door 16 is provided in the exterior wall 20, and the rear door 18 is provided in the exterior wall 21. The constructional details for the doors and windows will hereinafter be more fully explained.

The various rooms provided interiorly of the living unit 11 are delineated by the interior walls. Specifically, an interior wall 25 extends inwardly from that exterior wall 22 which forms the end facade to divide the bedrooms 13A and 13B, one from the other. An interior wall 26 extends inwardly from the exterior wall 20 which forms the front facade to divide the bedroom 13A from the combined eating and living area 15, and an interior wall 27 extends inwardly from the exterior wall 21 which forms the rear facade to divide the bedroom 13B from the bathroom 14. An additional interior wall 28 extends inwardly from the exterior wall 21 which forms the rear facade, and a return wall 29 may be provided at the innermost terminus of the interior wall 28. The interior walls 28 and 29 collectively serve to divide the bathroom 14 from the combined eating and living area 15.

An interior door 31A may be employed to provide selective privacy to one bedroom 13A, and a similar, interior door 31B may be employed to provide selective privacy to the other bedroom 13B. A third, interior door 31C may be employed to provide selective privacy to the bathroom 14.

As will be generally apparent from FIG. 2, a plurality of load bearing coupler members, identified generally by the numeral 30, are disposed at spaced intervals along the locus of points which delineate the exterior walls 20-22, the common wall 23, the interior walls 25-28 and the return wall 29. A successive plurality of panel members 35 are interposed between the successively spaced coupler members 30 to form the previously identified interior, as well as the exterior, walls. Certain additional structural components are employed in conjunction not only with fabricating, and hanging, the doors 16, 18 and 31 and the windows 19 but also with effecting the structural ties that must exist between the supporting base and the walls, the walls with each other and the walls with the roof, all during erection of the building structure 10 as will hereinafter be described in detail. In order to facilitate the disclosure of the present invention the plurality of structural components most commonly employed in the construction of the walls and roof of a building structure 10 will first be described in detail.

One of the primary structural components is the panel member 35. As best seen from FIG. 3, the panel member 35 has a body portion 36. The body portion 36 has planar, transversely spaced, substantially parallel, wall skins 38 and 39. A plurality of reinforcing ribs 40 extend transversely between the wall skins 38 and 39. The ribs 40 are, themselves, laterally spaced, one with respect to the others, and they are oriented substantially parallel to the lateral edges of the body portion 36.

The lateral edges of the body portion 36 are delineated by positioning shoulders 41 and 42 presented at the opposite ends of each wall skin. As depicted in FIG. 3, a positioning shoulder 41A defines one lateral edge of skin 38, and a corresponding, and opposed, positioning shoulder 41B

defines one lateral edge of wall skin 39. The positioning shoulders 41A and 41B are transversely opposed and define not only one lateral edge of the body portion 36 but also the offset juncture between the body portion 36 and the connecting tongue 45 which extends longitudinally along that lateral edge of the body portion defined by the positioning shoulders 41, as will be hereinafter described in greater detail.

Similarly, a positioning shoulder 42A defines the second lateral edge of skin 38, and a corresponding, and opposed, positioning shoulder 42B defines the second lateral edge of wall skin 39. The positioning shoulders 42A and 42B are transversely opposed and define not only the second lateral edge of the body portion 36 but also the offset juncture between the body portion 36 and the connecting tongue 46 which extends longitudinally along that lateral edge of the body portion defined by the positioning shoulders 42.

The tongue 45 has a transversely oriented closure wall 48 that is laterally spaced from the lateral edge of the body portion 36 defined by the positioning shoulders 41A and 41B. The transverse edges of the closure wall 48 are joined to transversely spaced, locking walls 49 and 50. A longitudinally extending locking groove 51 is recessed into the tongue 45 between the locking wall 49 and the body portion 36 such that the locking groove 51 lies parallel with, and adjacent to, the positioning shoulder 41A. A longitudinally extending locking groove 52 is similarly recessed into the tongue 45 between the locking wall 50 and the body portion 36 such that the locking groove 52 lies parallel with, and adjacent to, the positioning shoulder 41B.

The tongue 46 has a transversely oriented closure wall 53 that is laterally spaced from the lateral edge of the body portion 36 defined by the positioning shoulders 42A and 42B. The transverse edges of the closure wall 53 are joined to transversely spaced, locking walls 54 and 55. A longitudinally extending locking groove 56 is recessed into the tongue 46 between the locking wall 54 and the body portion 36 such that the locking groove 56 lies parallel with, and adjacent to, the positioning shoulder 42A. A longitudinally extending locking groove 58 is similarly recessed into the tongue 45 between the locking wall 55 and the body portion 36 such that the locking groove 58 lies parallel with, and adjacent to, the positioning shoulder 42B.

The pair of tongues 45 and 46 presented from the lateral edges 41 and 42, respectively, of the body portion 36 have a transverse thickness that is less that the transverse thickness of the body portion 36.

Specifically, th locking walls 49 and 54 are transversely offset with respect to the plane of the wall skin 38, and the locking walls 50 and 55 are transversely offset with respect to the plane of the wall skin 39. It is these lateral offsets of the four locking walls 49, 50, 54 and 55 relative to the two skin walls 38 and 39 which results in the transverse thickness of the tongues 45 and 46 being less that the transverse thickness of the body portion 36. The functional purpose for this deliberate disparity between the transverse thickness of the tongues 45 and 46 relative to the transverse thickness of the body portion 36 in each panel member 35 will be hereinafter more fully explained.

There are at least two types, and perhaps three sub-types, of coupler members 30 which may be employed in the construction of a building structure 10 embodying the concepts of the present invention. For example, there are the primary coupler members 30A, 30B, 30C and 30D, as depicted in FIGS. 4 through 7, respectively, and there is a secondary coupler member 30E, as depicted in FIG. 8.

Taking the coupler members in order, the primary coupler member 30A depicted in FIG. 4 is employed to effect a structural tie between two, linearly oriented members. Typically, a primary coupler member 30A might be employed to effect a structural tie between two panel members 35, a panel member 35 and a door 16, 18 or 31, a panel member 35 and a window 19 or any other desired arrangement wherein the structural components secured through a primary coupler member 30A are desired to be linearly oriented.

The primary coupler members 30A through 30D, inclusive, each have a body portion 61 that is preferably of box-shaped cross section. That is, the body portion 61 is hollow and has a generally rectilinear, external periphery which defines a plurality of exterior faces such as the four 62, 63, 64 and 65 depicted. The box-shaped cross section provides excellent bending strength with minimal material as well as excellent columnar strength with a superb L/R ratio.

At least one pair of connecting flanges 70 is presented from said body portion 61. Each connecting flange 70 has an extension arm 71 with proximal and distal edges 72 and 73, respectively. The proximal edge 72 on the extension arm 71 of each connecting flange 70 is integrally secured to the body portion 61 such that the extension arms 71 are each oriented in perpendicular relation with respect to one exterior face and in coplanar relation with respect to one, adjacent, exterior face.

As can be seen with reference to FIG. 4, the extension arm 71A incorporated in the first pair of connecting flanges 70A is oriented not only in perpendicular relation with respect to the exterior face 62 but also in coplanar r lation with respect to

the exterior face 65. Likewise, the extension arm 71B incorporated in the first pair of connecting flanges 70A is oriented not only in perpendicular relation with respect to the exterior face 62 but also in coplanar relation with respect to the exterior face 63. The extension arms 71A and 71B are thus disposed in transversely spaced, parallel relation to form the first pair of the connecting arms 70A.

A locking pawl 75 extends transversely outwardly from the distal edge 73 of each extension arm 71A and 71B forming the first pair of connecting flanges 70A. Specifically, pawl 75A is presented from the distal end 73 of the extension arm 71A, and the pawl 75B is presented from the distal end of the extension arm 71B. As can be seen from FIG. 4, the pawls 75A and 75B so provided extend toward each other in facing opposition.

The primary coupler member 30A depicted in FIG. 4, also employs a second pair of connecting flanges 70B that extend outwardly from said body portion 61 in a diametrically opposite direction relative to the first pair of connecting flanges 70A. As such, the extension arm 71C incorporated in the second pair of connecting flanges 70B is oriented not only in perpendicular relation with respect to the exterior face 64 but also in coplanar relation with respect to the exterior face 65. Likewise, the extension arm 71D incorporated in the second pair of connecting flanges 70B is oriented not only in perpendicular relation with respect to the exterior face 64 but also in coplanar relation with respect to the exterior face 63. The extension arms 71C and 71D are thus disposed in transversely spaced, parallel relation to form the second pair of the connecting arms 70B.

A locking pawl 75 also extends transversely outwardly from the distal edge 73 of each extension arm 71C and 71D in the second pair of connecting flanges 70B. The locking pawls 75C and 75D presented from the distal ends of the extension arms 71C and 71D, respectively, forming the second pair of connecting flanges 70B also extend toward each other in facing opposition.

The primary coupler member 30B depicted in FIG. 5 is employed to effect a structural tie between two perpendicularly oriented members. Typically, a primary coupler member 30B might be employed to effect a structural tie between two panel members 35, a panel member 35 and a door 16, 18 or 31, a panel member 35 and a window 19 or any other desired arrangement wherein the structural components secured through a primary coupler member 30B are desired to be perpendicularly oriented.

As should be apparent by a comparison of FIG. 5 with FIG. 4, the first pair of connecting flanges 70A incorporated on the primary coupler member 30B depicted in FIG. 5 are identical with the first pair of connecting flanges 70A incorporated on the primary coupler member 30A depicted in FIG. 4, and the description of the first pair of connecting flanges 70A need not, therefore, be reiterated. Nevertheless, the same numerical designations have been applied to each element in the structural configuration of the first pair of connecting flanges 70A depicted in FIG. 5 as appear in conjunction with the first pair of connecting flanges 70A depicted in FIG. 4 so that one may refer to the description set forth in conjunction with FIG. 4 should any question arise relative to the structural arrangement of the first pair of connecting flanges 70A employed with the primary coupler member 30B depicted in FIG. 5.

The primary coupler member 30B depicted in FIG. 5, also employs a second pair of connecting flanges 70C, but the second pair of connecting flanges 70C extend outwardly from said body portion 61 in a direction that is perpendicular relative to the direction at which the first pair of connecting flanges 70A extend outwardly from the body portion 61.

As such, the extension arm 71E incorporated in the second pair of connecting flanges 70C is oriented not only in perpendicular relation with respect to the exterior face 63 but also in coplanar relation with respect to the exterior face 64. Likewise, the extension arm 71F incorporated in the second pair of connecting flanges 70C is oriented not only in perpendicular relation with respect to the exterior face 63 but also in coplanar relation with respect to the exterior face 62. The extension arms 71E and 71F are thus disposed in transversely spaced, parallel relation to form the second pair of connecting flanges 70C on the primary coupler member 30B.

A locking pawl 75 also extends transversely outwardly from the distal edge 73 of each extension arm 71E and 71F in the second pair of connecting flanges 70C. That is, pawl 75E is presented from the distal end 73 of the extension arm 71E, and pawl 75F is presented form the distal end of the extension arm 71F. The locking pawls 75E and 75F thus presented from the distal ends of the extension arms 71E and 71F forming the second pair of connecting flanges 70C also extend toward each other in facing opposition.

The primary coupler member 30C depicted in FIG. 6 is employed to effect a structural tie between three members, two of which are linearly oriented and the third of which is perpendicularly oriented with respect to the other two. Typically, a primary coupler member 30C might be employed to effect a structural tie between three panel members 35, two panel members 35 and a door 16, 18 or 31, two panel members 35 and a window 19 or any other desired arrangement wherein the struc-

tural components converge to a common juncture point.

As should be apparent by a comparison of FIG. 6 with FIG. 4, the first and second pair of connecting flanges 70A and 70B incorporated on the primary coupler member 30C depicted in FIG. 6 are identical with the first and second pair of connecting flanges 70A and 70B incorporated on the primary coupler member 30A depicted in FIG. 4. As such, the description of the first and second pair of connecting flanges 70A and 70B need not, therefore, be reiterated. For convenience, however, the same numerical designations have been applied to each element in the structural configuration of the first and second pairs of connecting flanges 70A and 70B depicted in FIG. 6 as appear in conjunction with the first and second pairs of connecting flanges 70A and 70B depicted in FIG. 4 so that one may refer to the description set forth in conjunction with FIG. 4 should any question arise relative to the structural arrangement of the first or second pair of connecting flanges 70A or 70B employed with the primary coupler member 30C depicted in FIG. 6.

The primary coupler member 30C depicted in FIG. 6 also employs a third pair of connecting flanges 70C, but the third pair of connecting flanges 70C extend outwardly from said body portion 61 in a direction that is perpendicular relative to the direction at which the first and second pairs of connecting flanges 70A and 70B extend outwardly from the body portion 61.

As such, the third pair of connecting flanges 70C incorporated on the primary coupler member 30C depicted in FIG. 6 are identical with the second pair of connecting flanges 70C incorporated on the primary coupler member 30B depicted in FIG. 5. For that reason the description of the second pair of connecting flanges 70C described in conjunction with the primary coupler member 30B depicted in FIG. 5 need not, therefore, be reiterated to define the third pair of connecting flanges 70C utilized with the primary coupler member 30C. However, the same numerical designation has been applied to each element in the structural configuration of the third pair of connecting flanges 70C depicted in FIG. 6 as appear in conjunction with the second pair of connecting flanges 70C depicted in FIG. 5 so that one may refer to the description set forth in conjunction with FIG. 5 should any question arise relative to the structural arrangement of the third pair of connecting flanges 70C employed with the primary coupler member 30C depicted in FIG. 6.

The primary coupler member 30D depicted in FIG. 7 is employed to effect a structural tie between four members arranged in two pairs, each pair being linearly oriented with respect to each other and perpendicularly oriented with respect to the other pair. Typically, a primary coupler memb r 30D might be employed to effect a structural tie between four panel members 35, three panel members 35 and a door 16, 18 or 31, three panel members 35 and a window 19 or any other desired arrangement wherein four structural components converge to a common juncture point.

As should be apparent by a comparison of FIG. 7 with FIG. 6, the first, second and third pairs of connecting flanges 70A, 70B and 70C incorporated on the primary coupler member 30D depicted in FIG. 7 are identical with the first, second and third pairs of connecting flanges 70A, 70B and 70C incorporated on the primary coupler member 30C depicted in FIG. 6. As such, the description of the first, second and third pairs of connecting flanges 70A, 70B and 70C need not, therefore, be reiterated. Nevertheless, the same numerical designations have been applied to each element in the structural configuration of the first and second pairs of connector flanges 70A and 70B depicted in FIG. 7 as appear in conjunction with the first and second pairs of connecting flanges 70A ad 70B depicted in FIG. 6 and described in conjunction with FIG. 4 so that one may refer to the description set forth in conjunction with FIG. 4 should any question arise relative to the structural arrangement of the first and second pairs of connecting flanges 70A and 70B employed with the primary coupler member 30D depicted in FIG. 7.

Similarly, the same numerical designations have been applied to the various elements in the structural configuration of the third pair of connecting flanges 70C depicted in FIG. 6 and described in conjunction with FIG. 5 so that one may refer to the description set forth in conjunction with FIG. 5 should any question arise relative to the structural arrangement of the third pair of connecting flanges 70C employed with the primary coupler member 30D depicted in FIG. 7.

The primary coupler member 30D depicted in FIG. 7 also employs a fourth pair of connecting flanges 70D, and the fourth pair of connecting flanges 70D not only extend outwardly from said body portion 61 in a direction that is perpendicular relative to the direction at which the first and second pair of connecting flanges 70A and 70B extend outwardly from the body portion 61 but also extend outwardly from the body portion 61 in a direction that is diametrically opposite to the direction at which the third pair of connecting flanges 70C extend outwardly from the body portion 61.

As such, the extension arm 71G incorporated in the fourth pair of connecting flanges 70D is oriented not only in perpendicular relation with respect to the exterior face 65 but also in coplanar relation with respect to the exterior face 64. Likewise, the extension arm 71H incorporated in the

fourth pair of connecting flanges 70D is oriented not only in perpendicular relation with respect to the exterior face 65 but also in coplanar relation with respect to the exterior face 62. The extension arms 71G and 71H are thus disposed in transversely spaced, parallel relation to form a fourth pair of connecting arms 70D.

A locking pawl 75 also extends transversely outwardly from the distal edge 73 of each extension arm 71G and 71H in the fourth pair of connecting flanges 70D. The locking pawls 75G and 75H presented from the distal ends of the extension arms 71G and 71H forming the fourth pair of connecting flanges 70D also extend toward each other in facing opposition.

The secondary coupler member 30E depicted in FIG. 8 is also employed to effect a structural tie between two linearly oriented members. The secondary coupler member 30E is particularly adapted for use at those locations where a greater resistance is required to bending stresses than to columnar stresses or at those locations where the additional columnar strength afforded by the primary coupler members is not required. For example, secondary coupler members 30E may be alternated with the primary coupler members 30A in the construction of walls, assuming that sufficient columnar strength for the particular wall can be achieved by so alternating the coupler members. In addition, it has been found that in the construction of a roof one requires little, if any, resistance to a columnar stresses in comparison to the potentially high bending stresses. The secondary coupler member 30E is, therefore, particularly suited to usage in the construction of roofs, as will hereinafter be more fully described.

Turning, then, to a preferred configuration for the construction of the secondary coupler member 30E, the secondary coupler member employs a web portion 81 with a first and second pair of connecting flanges extending outwardly from said web portion in diametrically opposite directions.

As should be apparent by a comparison of FIG. 8 with FIG. 4, the first and second pair of connecting flanges 70A and 70B incorporated on the secondary coupler member 30E depicted in FIG. 8 are identical with the first and second pair of connecting flanges 70A and 70B incorporated on the primary coupler member 30A depicted in FIG. 4, and the description of the first and second pair of connecting flanges 70A and 70B need not, therefore, be reiterated. In this situation, as in the previous situations where identical elements are incorporated in a separate structural component, the same numerical designations have been applied to the various elements of the first and second pairs of connector flanges 70A and 70B depicted in FIG. 8 as appear in conjunction with the first and second pairs of connecting flanges 70A and 70B depicted in FIG. 4 so that one may refer to the description set forth in conjunction with FIG. 4 should any question arise relative to the structural arrangement of the first or second pair of connecting flanges 70A or 70B employed with the secondary coupler member 30E depicted in FIG. 8.

The jamb member 90 depicted in FIG. 9 is employed to effect a structural tie between a door 16, 18 or 31 and a coupler member 30, or a window 19 and a coupler member 30. As such, the jamb member 90 can be interconnected to any of the variations of the primary coupler members 30A through 30D, or, for that matter, the secondary member 30E. The jamb member 90 has a body portion 91 which presents transversely spaced, substantially parallel casing surfaces 92 and 93. At one lateral edge of the casing surface 92 a jamb surface 94A extends transversely of the body portion 91 in opposition to a jamb surface 94B which extends transversely of the body portion 91 at the corresponding lateral edge of the casing surface 93.

A stop block 95 extends laterally outwardly from the opposed, and aligned, jamb surfaces 94A and 94B to present oppositely directed stop surfaces 96. The stop surface 96A extends perpendicularly outwardly from the jamb surface 94A, and the stop surface 96B extends perpendicularly outwardly from the jamb surface 94B. The stop surfaces 96A and 96B are substantially parallel to each other and to the casing surfaces 92 and 93, as well. A closure surface 97 extends transversely of the stop block 95 in substantially perpendicular relation to the stop surfaces 96 and in substantially parallel relation to the jamb surfaces 94 to define one lateral edge of the jamb member 90.

The oppositely directed lateral edge of the jamb member 90 is delineated by positioning shoulders 42. A positioning shoulder 42A defines one lateral edge of the casing surface 92, and a corresponding, and opposed, positioning shoulder 42B defines one lateral edge of the casing surface 93, The positioning shoulders 42A and 42B are transversely opposed and define not only the second lateral edge of the jamb member 90 but also the offset juncture between the body portion 9I and the connecting tongue 46 which extends longitudinally along that lateral edge of the body portion defined by the positioning shoulders 42.

As will be apparent by a comparison of FIG. 9 with FIG. 3, the tongue 46 incorporated on the jamb member 90 is identical with the tongue 46 incorporated on the panel member 35, and the description of the tongue 46 need not, therefore, be reiterated. In this situation, as well, the same numerical designations have been applied to the tongue 46 on the jamb member 90 depicted in FIG.

9 as appear in conjunction with the tongue 46 incorporated on the panel member 35 so that one may refer to the description set forth in conjunction with FIG. 3 should any question arise relative to the structural configuration of the tongue 46 employed with the jamb member 90 depicted in FIG. 9.

Turning now to FIG. 10, the closure frame 100 is a structural member having a generally rectilinear overall outline that is interrupted by a first recess 101 and an oppositely directed second recess 102. One may also mentally view the closure frame 100 as being comprised of two smaller rectilinear configurations 103 and 104 that are contiguously juxtaposed, but offset, one with respect to the other, in order to provide two oppositely directed inside corners 105 and 106 which constitute the apex of the first and second recesses 101 and 102, respectively. No matter how one mentally envisions the closure frame 100, it may preferably be hollow to minimize unnecessary weight. As is also depicted in FIG. 10, a hollow, rectilinear glazing bead 110 will cooperatively interact with the recesses 101 or 102, as will hereinafter be more fully described.

The adjacent ends of selected lengths 111 and 112 of the closure frame 100, for example, may be mitered and joined together in the traditional manner to form a frame for receiving an insert 113. The insert 113 may be a transparent, or translucent, pane of glass, or the like. Conversely, the insert 113 may be an opaque sheet of plastic, or the like, depending upon the desires of the people using the building structure 10. In any event, the insert 113 may be received within the recess 102 which circumscribes the inside opening 114 outlined by the frame formed from selected lengths 111, 112 et cetera of the closure frame 100. So positioned within the recess 102, the insert 113 may be secured in position by appropriate lengths of the glazing bead 110 which may be demountably fastened to the closure frame 100 by virtue of a plurality of screws 115 which extend through the glazing bead 110 and into one wall 116 of the closure frame 100.

As an alternative to mitering the corners on selected lengths of the conjoined closure frame 100, it would also be quite feasible to employ a joinder plug 120 to secure the adjacent ends of two lengths 111 and 112 of the closure frame 100. As depicted in FIG. 10, the joinder plug 120 may have a corner portion 121 which will remain exposed and which may, if desired, have an exterior configuration which identically matches that of the closure frame members 100. In that way one can provide a smooth exterior surface to the entire assemblage which circumscribes the inside opening 114.

Suitably configured legs 122 and 123 may extend outwardly from the corner portion 121 of the joinder plug 120, preferably at right angles to each other, in order to be insertably received within the hollow interior 124 of those lengths 111 and 112 of the closure frame 100 to be joined. One may effect a permanent joinder by the use of an appropriate adhesive 125 between the legs 122 and 123 and the interior surface 126 of the closure frame 100. On the other hand, the lengths 111 and 112 of the closure frame 100 may be releasably secured to the legs 122 and 123 of the joinder plug 120 by the use of removable fasteners. The screw 115, for example, may serve the dual function of securing a glazing bead 110 to the closure frame 100 as well as securing the lengths 111 and 112 of the closure frame 100 to the joinder plug 120.

The structural components employed in the present invention -- those described above as well as those which will be hereinafter described -- may well comprise an extruded thermoplastic resin. Such resins are preferably reinforced with fibers such as fiberglass and provide a material commonly referred to as a fiber-reinforced plastic (FRP). While a variety of thermoplastic materials and fiber reinforcements are known, one particularly suitable FRP comprises vinyl chloride resins reinforced with glass fibers.

The amount of fiber reinforcement in such a product can range: broadly from about five to 50 percent by weight, based upon the combined weight of glass fibers and vinyl chloride resin; desirably from about 10 to 40 percent by weight; preferably about 15 to 35 percent by weight; and, most preferably about 30 percent by weight. A good disclosure of these products and the process for their preparation can be found in U.S. Pat. No. 4,536,360, the subject matter of which is incorporated herein by reference.

As should be evident to those skilled in the art, practice of the present invention does not require that the structural components comprise vinyl chloride resins reinforced by glass fiber and therefor , the invention is not to be limited thereto or by the disclosure of U.S. Pat. No. 4,536,360. Thus, the structural components may not be fiber reinforced or even thermoplastic so long as they can be manufactured in the configurations described herein.

Turning now to the construction of a modular building structure 10 using the foregoing structural components, one must first prepare a supporting base 130 (FIG. 1) upon which a modular building structure 10 can be erected. At this point it should be emphasized that the supporting base 130, or at least the locus of points which define the walls -- and particularly the exterior walls -- to be erected on the supporting base 130, must be accurately located, and dimensioned. The concepts of the present invention permit the various structural com-

ponents from which the building structure is to be constructed to be mass produced, off site, and delivered for assembly without special tools and without the special skills of the building trade craftsmen.

That is, the various structural components are simply to be interconnected by unskilled laborers, and after all the various structural components have been put together the result is a completed building structure 10. For those reasons, the dimensions, and layout, of the supporting base 130 are critical to the proper relation of each structural component to the previously, and subsequently, erected structural components as well as to all the structural components which comprise the completed building structure 10.

With that in mind, the supporting base 130 can well comprise a footing, a slab, a deck, a plurality of piers or any other arrangement by which to support the building structure 10. In any event, the supporting base 130 must present the locus of points which define at least the exterior walls of the building structure. One way by which to accomplish the critical objective of accurately delineating the aforesaid locus of points is to provide forms 131 (FIGS. 11 and 12) which will not only permit a supporting base 130 in the nature of a concrete footing, slab or the like to be poured with the necessary dimensional accuracy but also to provide a built-in arrangement for locating the means by which to tie selected primary coupler members 30 to the resulting supporting base 130.

With particular reference to FIG. 11, a pair of forms 131A and 131B, of the type which are customarily fabricated from steel, may be disposed, as shown, to define the outer periphery at one corner of a supporting base 130A upon which a building structure 10 as depicted in FIG. 1 can be erected. A plurality of such forms 131A and 131B may well be employed to delineate the outer periphery of the entire supporting base 130A.

A plurality of tabs 132 are fixedly secured to, and extend horizontally from, the top edge 133 of the forms 131A and 131B to overlie the prepared surface 134 upon which the supporting base 130A will be poured, and each tab 132 presents a recessed guide slot 135 that is of appropriate length and width accurately to determine the locations along the locus of points which define the exterior walls of the building structure 10 at which it is desired, or required, that a reinforcing rod 136 be located to tie selected primary coupler members 30A-30D to the supporting base 130A.

By pre-numbering a complete set of the aforesaid forms 131A and 131B required to define the entire periphery of the supporting base 130A, and/or by providing means well known to the art to assure that the forms 131A and 131B can only be fitted together in a predetermined manner, even an unskilled laborer will be able accurately to position the plurality of such forms 131A and 13IB required to describe the outer periphery of the supporting base 130A. As the supporting base 130A is poured, the laborer will insert suitable reinforcing rods 136 into the freshly poured concrete, using the recessed guide slots 135 accurately to locate each such reinforcing rod 136. A supporting base 130A poured onto the prepared surface 134 circumscribed by a plurality of forms 131A and 131B provides a cross section in conformity with that depicted in FIG. 13.

At least one other style of form 131 will also be subsequently described in detail herein. Irrespective of which style form is employed, however, the objective is to provide a supporting base 130 from which the building can be erected, and to which selective coupler members 30 can be secured. In this regard one must assure not only that preselected coupler members 30 are permanently secured to the supporting base 130 when the building has been completed but also that some means are provided to effect an interim anchoring of the coupler members 30 relative to the supporting base 130 during construction.

In many geographic areas it is mandatory that some permanent anchor means be provided at the base of at least the exterior walls to provide a rigid resistance against lateral wind loading. Wind loads can reach rather monumental proportion when one is designing a structure to resist wind velocities of hurricane magnitude. In addition, it is also highly desirable, and generally required, that some means be provided to preclude the admission of water between the exterior walls and the supporting base. Both of these objectives are achieved by the three arrangements depicted for permanently securing selected coupler members to the supporting base, as will be hereinafter more fully explained.

The means for effecting the anchoring of the coupler members to the supporting base should -- in addition to effecting a permanent anchor by which to resist the wind loading applied against the outside of the exterior walls, which tends to force the walls inwardly of the building -- effect an interim resistance to loadings applied against the interior of the exterior walls, at least prior to the time that the permanent anchoring has been achieved. Two of the arrangements depicted herein to effect permanent anchoring against lateral loads effect the necessary interim resistance, as well, but the third arrangement disclosed herein, and the one which is first described, requires assistance during the construction phase in order to provide the necessary interim protection.

With particular reference to FIG. 13 (which depicts the "third" arrangement mentioned above)

it can be seen that the reinforcing rod 136, structurally anchored in the supporting base 130A by virtue of the well know provision of a hook 138 buried in the concrete from which the supporting base 130A is formed, extends vertically upwardly out of the supporting base 130A to penetrate the sill plate 140A, through a bore 141, to be received interiorly of a hollow, primary, coupler member, such as member 30A depicted. The interior of the hollow coupler member 30A may be filled with concrete 142 to encase the reinforcing rod 136. In order to achieve the necessary structural tie between the concrete 142 and the reinforcing rod 136, the reinforcing rod 136 should normally extend upwardly on the order of approximately 18 to 24 inches (approximately 45 to 61 cm.). The concrete 142 thereby assures a permanent anchoring of the coupler member 30A to the supporting base 130, through the reinforcing rod 136 to resist substantial lateral loads, but only after the concrete has "cured."

The sill plate 140A employed in the arrangement depicted in FIG. 13 may be in the configuration of a Z-bar. As such, the central web portion 143 thereof has lateral edges from which flange portions 144 and 145 extend perpendicularly outwardly, but in opposite directions. The flange portion 144 overlies, and preferably engages, the peripheral edge 146 of the supporting base 130A. The flange 145, on the other hand, extends upwardly from the supporting base 130A to engage the primary coupler member 30A along that face 65 directed toward the interior of the building structure 10. In that way wind loading applied exteriorly of a wall erected upon a sill plate 140A will be resisted by the substantially vertically extending flange 145, even prior to the time that the concrete 142 has cured. It should also be appreciated that the flange 145 effects a continuous resistance to lateral loads applied exteriorly of the building structure 10 along the full length of each exterior wall, thus supplementing the resistance effected by the reinforcing rods 136 even after the concrete in which they are encased has cured.

The substantially vertical disposition of the flange 145 relative to the horizontally disposed central web portion 143 also serves as an effective means by which to preclude the admission of water into the building 10 from beneath the exterior walls.

As will be readily appreciated, however, until such time as the concrete 142 cures, the structural arrangement depicted in FIG. 13 does not provide an interim anchor which would preclude the movement of either the primary coupler member 30 or the other structural components from which the wall 20 is formed from moving outwardly away from the flange 145. To obviate this problem one may, for example, drive stakes 147 into the ground surrounding the supporting base 130A and utilize those stakes, or other comparable means, to effect the necessary interim anchoring of the wall 20 against laterally outward movement until such time as the permanent anchor means becomes fully operational. As shown, a shim, or block, 148 may be interposed between the stake 147 and th wall 20 to effect the necessary interim anchor.

If the need to supply interim anchor means by virtue of some temporary structural arrangement not incorporated in the sill plate 140 itself is unacceptable, one may certainly employ an alternative configuration for a sill plate, representative examples of which will hereinafter be described.

As an alternative to the forms 131A and 131B, one may, for example, employ the forms 131C, depicted in FIG. 12, which are also customarily fabricated from steel, to define the outer periphery of one side of a supporting base 130B. A sill plate 140B may, by means well known to the art, be releasably secured to, and extend horizontally outwardly from, the top edge 133 of each form 131C to overlie the prepared surface 134 upon which the supporting base 130B will be poured. As is best seen from FIG. 14, the sill plate 140B may be retained in the concrete which constitutes the supporting base 130B even after the forms 131C are removed.

By pre-numbering a complete set of the aforesaid forms 131C required to define the entire periphery of the supporting base 130B, and/or by providing means well known to the art to assure that the forms 131C can only be fitted together in a predetermined manner, even an unskilled laborer will be able accurately to locate and position the successive plurality of such forms 1 31C required to delineate the outer periphery of the supporting base 130B. As the supporting base 130B is poured, a laborer will insert suitable reinforcing rods 136 into the freshly poured concrete, using the bores 149 provided at longitudinally spaced intervals along the sill plate 140B accurately to designate the locations at which the reinforcing rods 136 are to be inserted into the concrete as the supporting base 130B, which is at least peripherally defined by the forms 130C, is poured. A supporting base 130B poured onto the prepared surface 134 circumscribed by a plurality of forms 131C provides a cross section in conformity with that perhaps best depicted in FIG. 14.

In the embodiment of the supporting base 130B depicted in FIG. 14, as well, the reinforcing rod 136 extends vertically upwardly out of the supporting base 130B to penetrate the sill plate 140B, through bore 149, and to be received interiorly of the hollow primary coupler member 30A depicted. The interior of each hollow coupler members 30A into which a reinforcing rod 136 extends

is preferably also filled with concrete 142 in order to achieve the necessary structural tie between the coupler 30A and the supporting base 130B, through reinforcing rod 136, as heretofore explained in conjunction with the description of the supporting base 130A.

The sill plate 140B employed in the arrangement depicted in FIGS. 12 and 14 may be in the configuration of a J-bar. The central web portion 150 of the sill plate 140B is disposed substantially horizontally, and a first flange portion 151 extends substantially perpendicularly upwardly from one lateral edge of the central web portion 150. As such, when the sill plate 140B is supported by the form 131C the concrete poured thereunder delineates a shelf 152 in the peripheral edge 153 of the supporting base 130B. That surface of the shelf 152 which is formed by the central web portion 150 becomes a substantially horizontally oriented bearing surface 154, and that surface of the shelf 152 which is formed by the first flange portion 151 becomes a substantially vertically oriented reaction surface 155. The first flange portion 151 remains in contiguous juxtaposition with the reaction surface 155 and is, to that extent, also properly considered to be a portion of the reaction surface which is engaged by that face 65 on the primary coupler member 30A which is directed toward the interior of the building 10. Any wind loading applied exteriorly of the wall -- wall 20, for example, as depicted -- in which the coupler member 30A is employed will be resisted not only by the reinforcing rod 136 but also by the substantially vertically extending first flange portion 151 and the reaction surface 155 presented by the shelf 152 of the supporting base 130B.

The substantially vertical disposition of the first flange portion 151 relative to the horizontally disposed central web portion 150 also serves as an effective means by which to preclude the admission of water into the building 10 from beneath the wall 20.

A second flange extends outwardly from the other lateral edge of the web portion 150. At least a first portion 158 of the second flange extends outwardly of the web portion 150 in the same direction as the first flange 151, and a second portion 159 of the second flange extends outward of the web portion 150 in an opposite direction relative to the first flange portion 151. The first portion 158 of the second flange is thus disposed in parallel, laterally spaced relation relative to the first flange portion 151 and may well serve as the interim anchor means by which to resist any lateral forces applied against the interior of any wall erected upon the sill plate 140B.

The second portion 159 of the second flange overlies, and preferably engages, a portion of the peripheral edge 153 of the supporting base 130B. The second portion 159 of the second flange, therefore, primarily serves as a decorative means by which to camouflage the visible boundary between the central web portion 150 of the sill plate 140B and the supporting base 130B.

As should now be apparent, if the sill plate 140B is employed along the full perimeter of the building 10, it will serve to achieve the aforesaid, desired objectives therealong.

When one calculates the stresses encountered at the connections between the primary coupler members 30A-30D and the supporting base 130 on which the building structure 10 rests it will generally be determined that only certain of the hollow, primary coupler members 30A-30D will be required to be filled with concrete. At those locations along the locus of points defining the exterior walls where the primary coupler members 30A-30D must be filled with concrete in order to effect a structural tie between the coupler members and the supporting base 130, it will be highly desirable that the primary coupler members 30A-30D fully engage the sill plate 140, or even the supporting base 130 itself. At other locations the structural components forming the exterior walls may either rest upon the sill plate 140 itself or they may rest upon a member interposed between the vertically oriented structural components and the sill plate 140.

For example, as depicted in FIG. 18, a jamb member 90 is capable of being cooperatively received on the web portion 150 and between the flanges 151 and 158 of the sill plate 140B. Should the jamb member 90 be disposed beneath the structural members other than the primary coupler members 30, it is highly desirable that the downwardly directed ends of the other structural members which engage the jamb member 90 be recessed in a configuration which matingly engages the upwardly directed cross sectional profile of the jamb member 90. However, at those locations along the exterior walls where either a door 16 or 18 or a window 19 will be located, the doors and windows will cooperatively engage the jamb member 90, as will hereinafter be more fully explained in conjunction with description of the interaction between the closure frames 100 and the jamb members 90.

The last of the representative sill plates to be described herein is best depicted in FIG. 21 and is generally identified by the alphanumeric designation 140C. Specifically, the sill plate 140C has a horizontally disposed, generally planar, backing 165. A stop block 166 extends vertically upwardly from the medial portion of the backing 165 such that the portions of the backing 165 extending laterally outwardly from the stop block 166 present opposed, and aligned, jamb surfaces 168A and

168B. The lateral walls of the stop block 166 present oppositely directed stop surfaces 169A and 169B. The stop surface 169A extends perpendicularly upwardly from the jamb surface 168A, and the stop surface 169B extends perpendicularly upwardly from the jamb surface 168B. As such, th stop surfaces 169A and 169B are substantially parallel to each other. A closure surface 170 extends transversely of the stop block 166 in substantially perpendicular relation to the stop surfaces 169 and in substantially parallel relation to the jamb surfaces 168 to define the uppermost surface of the sill plate 140C.

The stop block 166 thus extends upwardly from the backing 165 to engage the structural components along the walls of the building structure 10. Wind, or other lateral, loading applied against any wall erected on a sill plate 140C will be resisted not only by the reinforcing rods received interiorly of those primary coupler members 30A-30D which are filled with concrete, as heretofore discussed, but also by the interaction between the substantially vertically extending stop block 166 and the structural components from which the wall is formed. As such, the configuration of the sill plate 140C can serve as an interim anchor, if some means is provided to secure the sill plate 140C to the supporting base 130A during erection of the building structure 10.

A Ram Set fastener 171, as depicted in FIG. 21, constitutes one means by which to secure a sill plate 140C to a supporting base 130A. Specifically, the fastener 171 attaches that portion of the backing 165 extending laterally of the stop block 166 to the supporting base 130A. This approach permits the sill plate 140C to be positioned, and secured, after the concrete forming the supporting base 130A has cured. It should be noted, however, that it may be preferable to secure only that portion of the backing 165 which presents the jamb surface 168B, as shown, inasmuch as that portion of the backing 165 which presents the jamb surface 168A may be so close to the peripheral edge 146 of the supporting base 130A that insertion of the fastener 173 could spall the peripheral edge 146 of the supporting base 130A.

FIG. 27 discloses an alternative form of sill plate 140C′. Sill plate 140C′ is virtually identical with sill plate 140C, except that sill plate 140C′ incorporates a built-in, mechanical interconnect 172 which extends downwardly from the backing 165. The built-in interconnect 172 may comprise a leg 173 that is formed integrally with, and which extends downwardly from, the backing 165 to terminate in a bulbous foot portion 174. Such an alternative construction for securing the sill plate 140C′ to the supporting base 130A would require that the sill plate 140C′ be set into the concrete of the supporting base 130A before the concrete hardens. Embedding the interconnect 172 into the concrete forming the supporting base 130A would allow the sill plate 140C′ to provide the interim anchor desired during erection of the building structure 10.

Referring again to FIG. 21, the ends of the structural components, panel member 35J is depicted, which engage the sill plate 140C (or, for that matter, sill plate 140C′) should be recessed, as at 175, to conform with the cross sectional profile of the sill plate 140C or 140C′. For example, the end edges 176A and 176B of the respective wall skins 38 and 39 on the panel member 35 may rest directly on the supporting base 130A, but the transverse elements of the panel member 35, such as the closure walls, not depicted in that figure, and the ribs 40, as depicted, are recessed in a stepped fashion to present end edges 177A and 177B which engage the jamb surfaces 168A and 168B, respectively, on the sill plate 140C or 140C′ and an end edge 178 which engages the closure surface 170 on the sill plate 140C or 140C′. The ends of the other coupler members 30 are similarly recessed to engage the sill plate 140C or 140C′, and this arrangement works quite well to effect the desired interim anchor between the wall 20 -- or any other exterior, or interior, walls -- and the supporting base 130A until such time as the permanent anchor therebetween becomes fully operational.

By providing a recess 175 at both ends of each structural component two objectives are achieved. First, and most obvious, the laborers would not be required to orient each structural component during the erection process, and second, the recess 175 at the top of each structural component would form a race extending longitudinally of each wall through which the electrical wiring could be routed. An exemplary representation of the use of a recess 175 at both ends of each structural component is further depicted in FIG. 28. As shown, a panel member 35 is operatively engaged by one form of a primary coupler member-i.e., 30A -- as well as a secondary coupler member 30E, and both ends of all three structural components are provided with a recess 175. From that representative depiction it should now be apparent that any, or all, of the structural components employed in a building structure 10 embodying the concepts of the present invention can be similarly recessed.

At those locations along the locus of points defining the exterior walls where the primary coupler members 30A-30D must be filled with concrete in order to effect a structural tie between the coupler members 30A-30D and the supporting base 130A, it will be highly desirable that the primary coupler members 30A30D fully engage the supporting base 130A itself rather than the sill plate

140C or 140C′ in order not only to assure that the desired tie is effected between th concret interiorly of the primary coupler members 30A-30D and the reinforcing rod 136 extending upwardly from the supporting base 130A at those locations but also to assure that the columnar load supported by at least those primary coupler members 30A-30D which are filled with concrete 142 is transferred directly to the supporting base 130A without the intervention of any component that might not be designed to support the columnar load to be carried by a concrete filled, primary coupler members 30A-30D.

The substantially vertical disposition of the stop block 166 relative to the horizontally disposed backing 165 also serves as an effective means by which to preclude the passage of water beneath any wall erected thereon. Obviously, therefore, if the sill plate 140C or 140C′ is employed along the full perimeter of the building 10, except at those locations where a primary coupler member 30A30D is to be filled with concrete, the sill plate 140C or 140C′ will fully achieve its objectives.

With a basic understanding of the structural components heretofore described as well as the several variations by which one may tie those structural components to the representative supporting bases disclosed, one is ready to consider one or more representative methods by which to erect the walls of a building structure 10.

It will be assumed that the appropriate supporting base 130 has been poured with the reinforcing rods 136 having been secured within the supporting base at accurately located, spaced intervals along at least the locus of points defining the exterior walls. It will be further assumed that the selected sill plates 140 have also been timely positioned. With the description heretofore supplied one skilled in the art would be able to prefabricate the necessary components and complete the supporting base 130 in preparation to the erection of the walls for a building structure 10.

To erect the walls themselves, there are generally two diverse approaches that can be employed. That is, the walls can either be directly assembled in their final, vertical disposition, or the walls can be assembled at ground level and then raised into their final, vertical position. Either approach is acceptable, but there will likely be those who prefer one method over the other.

To erect the walls in situ at least one laborer will require a ladder, stilts or some form of scaffolding. Starting, for example, at a corner such as the corner between the front and end walls 20 and 22 which is best seen in FIG. 1, the laborers may begin to erect wall 22 by positioning two sequential panel members 35A and 35B in linear juxtaposition along the selected sill plate 140 which defines the locus of points at which the wall 22 is to be erected on the supporting base 130. At this point it should be explained that the following description shall begin with the erection of wall 22 solely by way of example. Those who understand the invention could, as easily, start with virtually any other wall. With that understanding and with the panel members 35A and 35B positioned as previously described, the laborer on the scaffolding, or the like, may take a secondary coupler member 30E and slide it vertically between the linearly juxtaposed panel members 35A and 35B such that, as depicted in FIG. 16, the connecting flanges 70A on the secondary coupler member 30E operatively engage the tongue 45 on panel 35A and the connecting flanges 70B operatively engage the tongue 46 on panel member 35B.

Operative engagement of the connecting flanges 70A on the secondary coupler member 30E with the tongue 45 on the panel member 35A requires that the pawls 75A and 75B on the connecting flanges 70A are slidably received within the locking grooves 51 and 52, respectively, presented from the tongue 45 of panel member 35A. Similarly, operative engagement of the connecting flanges 70B on the secondary coupler member 30E with the tongue 46 on panel member 35B requires that the pawls 75C and 75D on the connecting flanges 70B are slidably received within the locking grooves 56 and 58, respectively, presented from the tongue 46 of panel member 35B. When the flanges 75A-75D are so engaged with the locking grooves 51, 52, 56 and 58, respectively, on the linearly juxtaposed panel members 35A and 35B, the secondary coupler member 30E will relatively easily slide downwardly between the panel members 35A and 35B until the lower end of the secondary coupler member 30E properly engages the sill plate 140. At that time the panel member 35A and 35B are fully tied to the coupler member 30E, and thus to each other.

Reference to FIG. 16 will also reveal the functional purpose of having the tongues 45 and 46 of lesser transverse thickness than the thickness of the body portion 36 of the panel members 35 from which the tongues are presented. By making the transverse offset between the locking wall 49 and the wall skin 38 on panel member 35A equal to the transverse thickness of the extension arm 71A of the connecting flanges 70A, the surface 65 of the secondary coupler member 30E will be located coplanar with the surface of the wall skin 38 on the wall panel 35A. With all the transverse offsets between the wall skins 38 and 39 on the panel members 35 and the corresponding locking walls 49, 50, 54 and 55 on the connecting tongues 45 and/or 46 being so dimensioned, the interior and the exterior surfaces of the end wall 22 defined by

the wall skins 38 and 39 on successiv panel members 35 across the length of the wall will be virtually flush with each other and with the appropriate faces 62-65 on the coupler members 30 used to interconnect the panel members 35.

Continuing with the explanation of one method by which to erect at least the outer walls of a building structure 10, the laborers may position a third, sequential panel member 35C in linear alignment with the now tied panel members 35A and 35B. The third panel member 35C, however, will be modestly spaced, though aligned, with panel member 35B, as best represented in FIG. 15. The aligned, but modestly spaced, disposition of the panel members 35B and 35C permits the laborer on the scaffolding, or the like, to take a primary coupler member 30A and slide it vertically between the panel members 35B and 35C such that the connecting flanges 70A on the primary coupler member 30A engage the tongue 45 on panel member 35B and the connecting flanges 70B on the primary coupler member 30A engage the tongue 46 on the panel member 35C.

In the arrangement depicted in FIG. 15, as well, engagement of the connecting flanges 70A on the primary coupler member 30A with the tongue 45 on the panel member 35B requires that the pawls 75A and 75B on the connecting flanges 70A are slidably received within the locking grooves 51 and 52, respectively, presented from the tongue 45 of panel member 35B. Similarly, engagement of the connecting flanges 70B on the primary coupler member 30A with the tongue 46 on panel member 35C requires that the pawls 75C and 75D on the connecting flanges 70B are slidably received within the locking grooves 56 and 58, respectively, presented from the tongue 46 of panel member 35C. When the flanges 75A-75D are so engaged with the locking grooves 51, 52, 56 and 58, respectively, on the aligned, but moderately spaced, panel members 35B and 35C, the primary coupler member 30A will relatively easily slide downwardly between the panel members 35B and 35C until the lower end of the primary coupler member 30A properly engages the sill plate 140. At that time the panel member 35B and 35C are fully tied to the coupler member 30A, and thus to each other.

The panel members employed to erect the walls 20 and 21 should all be of preferably the same height. However, it should be appreciated that when erecting the end wall 22, as described above, as well as the common wall 23, the successive panel members 35 must be of progressively increasing height, and the upper ends should be inclined to conform to the pitch of each slope 24A and 24B of the roof 24 as the slop s 24A and 24B converge upwardly toward the ridge 269. The progressive increase in the height of the panel members 35 forming the end wall 22, for example, should b apparent from viewing FIGS. 25 and 26.

It should be understood that the lower ends of each of the members heretofore assembled should be configured, as necessary, to engage the selected sill plate 140. It should also b understood that the us of a reinforcing rod would not likely b required to tie the structural components heretofore assembled to the supporting base 130. However, it is likely that a reinforcing rod would likely be required at the intersection of walls 20 and 22, and for that reason erection of the panel member 35D in wall 20 will now be described.

For that purpose the laborers would position the panel member 35D perpendicularly with respect to the previously erected panel members 35A-35C and coincident with the selected sill plate 140 which defines that locus of points along which the wall 20 is to be erected on the supporting base 130. With the panel member 35D thus positioned relative to panel member 35A the laborer on the scaffolding, or the like, may take a primary coupler member 30B and slide it vertically between the perpendicularly oriented panel members 35A and 35D such that the connecting flanges 70A on the coupler member 30B engage the tongue 46 on panel 35A and the connecting flanges 70C engage the tongue 45 on panel member 35D. Because the operative engagement of the connecting flanges 70A and 70C with the respective tongues on the panel members 35A and 35D is the same as heretofore explained in conjunction with FIGS. 15 and 16, there is no need to depict, or to describe, the details of that joinder. Suffice it to say that engagement of the primary coupler member 30B with the panel members 35A and 35D effects a tie between each panel member 35A and 35D as well as the primary coupler member 30B, and thus between the panel members 35A and 35D themselves.

It is also quite likely that a primary coupler member employed at a corner of the building structure 10 should be tied, in turn, to the supporting base 130 upon which the building structure 10 is being erected. As such, when the coupler member 30B is operatively insertable between the perpendicularly oriented panel members 35A and 35D it will also slide longitudinally over the vertically disposed reinforcing rod 136 located at that corner of the building structure 10.

Erection of the walls thus continues, component by component. For example, one could continue along wall 20 by positioning a successive panel member 35E aligned with panel member 35D and joining those two panel members by virtue of another, secondary coupler member 30E which would be insertably received therebetween in the manner previously depicted and described in conjunction with the joinder of panel members 35A and

35B.

To that edge of the panel member 35E not tied to the secondary coupler member 30E one may secure a primary coupler member 30A. This coupler member 30A would serve as a portion of the structural window framing "stud" on the left side of the opening 180 (as viewed in FIG. 1) within which the composite window 19A would be located. Another coupler member 30A could also serve as the structural window framing stud on the opposite, or right, side of the opening 180, and that coupler member 30A could be tied -- in the manner heretofore described in detail relative to the tying of panel member 35C to the primary coupler member 30A -- to panel member 35F.

A jamb member 90 would be supported from the primary coupler members 30A defining each side of the opening 180. The arrangement by which a jamb member 90 is supported from a primary couple member 30 is, perhaps, best represented in FIG. 17. With particular reference to FIG. 17 it will be seen that the connecting flanges 70B on the primary coupler member 30A engage the tongue 46 on the jamb member 90. That is, the respective locking pawls 75C and 75D presented from the extension arms 71C and 71D of the connecting flanges 70B are slidably received within the respective locking grooves 56 and 58 in the tongue 46 of the jamb member 90.

As shown in FIG. 1, the window 19A is a composite window. That is, the window 19A may be comprised of a series of four, vertically stacked window units 181A- 181D. FIG. 17 depicts the lateral relationship of the window unit 181B relative to the jamb member 90, and, as shown, one mounting arm 182 of a hinge 183 may be secured by conventional fastening means such as adhesive, screws or rivets (not shown) to the casing surface 92 on the body portion 91 of the jamb member 90, and the second mounting arm 184 of the hinge 183 may be secured to the stile 185 formed by a length of the closure frame 100. An ear 186 extends outwardly from the mounting arm 182 to lie in adjacent juxtaposition to an ear 188 which extends outwardly from the mounting arm 184. A hinge pin 189 extends between, and operatively connects, the two ears 186 and 188 to permit relative movement of the mounting arms 182 and 184 about the axis defined by the hinge pins 189. A comparable hinge arrangement may be provided on both sides of each window unit 181A- 181D in order to permit each window unit to swing relative to the primary coupler members 30A, and the associated jamb members 90, from which the window units 181 are supported. As will also be seen from FIG. 17, an appropriate sealing strip, such as the weatherstripping 190, can be interposed between the stop surface 96A on the jamb member 90 and the stile 185 of the window unit 181B.

With reference to FIG. 27 one can see how a vertically stacked, successive series of window units 181A- 181D interact with each other to permit each window unit 181A- 181D to be individually opened and closed. To begin at the bottom of the stack, a stop block is presented from the supporting base 130A. One means to present a stop block, such as 95, would be to employ a jamb member 90, as depicted in FIG. 18. Another means for providing a stop block 166 at the desired location would be to employ a sill plate 140C, as shown in FIG. 27. The bottom rail 191 (also formed by a length of the closure frame 100) of the window unit 181A engages the stop surface 169A on the stop block 166, and an appropriate sealing strip 190 may be interposed therebetween.

The uppermost boundary for the inside opening 114 of the window unit 181A constitutes an upper, meeting rail 192 (also formed by a length of the closure frame 100) which is disposed in parallel relation to the bottom rail 191. The lateral ends of the horizontally disposed bottom rail 191 and the upper, meeting rail 192 are joined, as in the manner depicted in FIG. 10, to vertically disposed, left and right stiles 185.

A blind stop 193 is secured to the upper, meeting rail 192 and extends vertically upwardly therefrom. Specifically, the blind stop 193 -- which may comprise a suitable length of a structural body that may be hollow, and of rectilinear cross section, such that it is generally similar to the glazing bead 110, except that it has a greater dimension in at least one direction transversely of its length -- is secured interiorly of the recess 101 presented by the closure frame 100 from which the upper, meeting rail 192 is formed. As shown, the blind stop 193 may be secured, as by a plurality of fasteners such as the screws 197, to the wall 194 presented from the length of closure frame 100 forming the upper, meeting rail 192, and if a sealing strip 190 is to be employed between the blind stop 193 on window unit 181A and the window unit 181B, as hereinafter described, it may be desirable to position a shim 195 between the blind stop 193 and the wall 194 on the upper, meeting rail 192, as shown.

The lowermost member of the next, upwardly successive window unit 181B is a bottom, meeting rail 196 which may also be formed from a length of the closure frame 100. As can best be visualized by reference to FIG. 27, the bottom, meeting rail 196 in window unit 181B is oriented in exactly the same disposition as the bottom rail 191 in window unit 181A, and even though the upper, meeting rail 192 of window unit 181A has an identical cross section to the bottom, meeting rail 196 of window unit 181B, they are disposed in mirrored relation when incorporated on successively upwardly

stacked window units 181A and 181B. As such, the blind stop 193 presented from, and secured to, the upper meeting rail 192 of window unit 181A is engaged by the wall 194 of the r cess 101 in the closure frame 100 from which th bottom, meeting rail 196 of window unit 181B is formed. If a sealing strip 190 is to be employed between the window units 181A and 181B, it may well be interposed between the blind stop 193 on window unit 181A and the wall 194 in the bottom, meeting rail 196 of window unit 181B.

In order to be able to open the window unit 181A without interference between the blind stop 193 on the upper, meeting rail 192 of window unit 181A and the bottom, meeting rail 196 of window unit 181B it is necessary that the window unit 181A pivot about an axis, such as the horizontal axis designated by the numeral 198, which allows the uppermost, outer corner 199 on the blind stop 193 to swing inwardly of the structure 10 and away from the bottom, meeting rail 196 on the window unit 181B.

The foregoing arrangement may be repeated successively upwardly until the desired number of window units, such as the four 181A-181D depicted in FIG. 1, are stacked in the window opening 180 between the two, vertically disposed, primary coupler members 30A which delineate the sides of the window opening 180.

As is also depicted in FIG. 27, the uppermost window unit 181D does not utilize a blind stop 193. The upper extremity of the window opening 180 may well be delineated by a jamb member 90 that is supported from a wall cap assembly 200, the details of which will be hereinafter more fully described. As such, the wall 194 on the length of closure frame 100 which forms the upper, meeting rail 201 on the window unit 181D engages the stop surface 96A on the stop block 95 presented from the jamb member 90, and a sealing strip 190 may be interposed therebetween. Because of the aforedescribed difference between the window unit 181D and the other window units 181A- 181C it will be imperative that the horizontally disposed, pivotal axis 202 about which the window unit 181D swings be located such that the uppermost, interior corner 203 on the recess 101 in the closure frame 100 which forms the upper, meeting rail 210 swing downwardly and outwardly away from the stop block 95 on jamb member 90.

The windows 19B-19E can each be assembled in the fashion of window 19A to include one or more window units 181.

Continuing now with the assembly of wall 20 it will be noted that one or both of the primary coupler members 30A forming the sides of the window opening 180 may be designated to encase a reinforcing rod 136 encapsulated in concrete 142, as is also depicted in FIG. 17.

The lateral edge of the panel member 35F that is opposite to the lateral edge tied to the primary coupler member 30A which forms the right side of the window opening 180 (as viewed in FIG. 1) may be tied to a primary coupler member 30C in order to effect the requisite structural tie between the interior wall 26 and the exterior wall 20 which is to be intersected by the interior wall 26 at that location.

To prepare for erecting the primary coupler 30C in such a way as to effect a tie between the interior wall 26 and the exterior wall 20 the laborer will position a panel member 35G in linear alignment with the previously erected panel members 35D, 35E and 35F, as well as the window 19A, which cumulatively comprise the exterior wall 20 to that location. The panel member 35G, however, will be modestly spaced, though aligned, with panel member 35F in the same manner as heretofore described in conjunction with the tying of panel member 35B and 35C. In addition, the laborer will position a vertically disposed panel member 35H (FIG. 2) perpendicularly with respect to the plane of wall 20 and convergent upon the modest space between the aligned panel members 35F and 35G. As such, the panel member 35H will be oriented in alignment with the locus of points along which the interior wall 26 is to be erected.

The sill plate 140C is also highly suitable for use in designating the locus of points upon which each interior wall will be erected, and a length of the sill plate 140C may also be disposed to extend perpendicularly inwardly from the exterior wall 20 not only to define the location of the interior wall 26 but also to facilitate the physical positioning of the panel member 35H during erection of the building structure 10.

With the three panel members 35F-35H properly positioned, the laborer on the scaffolding, or the like, may slide the primary coupler member 30C vertically between the three converging panel members 35F-35H such that, simultaneously: the connecting flanges 70A on the primary coupler member 30C will engage the tongue 46 on panel member 35F; the connecting flanges 70B will engage the tongue 45 on panel member 35G; and, the connecting flanges 70C will engage the tongue 45 on panel member 35H.

Because engagement of the connecting flanges 70A-70C with the respective tongues on the panel members 35F-35H is accomplished in the same manner as heretofore explained in considerable detail relative to the tying of the previously erected panel members 35 with the previously erected coupler members 30, there is no need to repeat either a depiction, or a description, of the details by which such a joinder is effected. Suffice it to say

that engagement of the primary coupler member 30C with the panel members 35F-35H effects a tie between each panel member 35F, 35G and 35H to the primary coupler member 30C, and thus between the panel members 35F-35H themselves.

Continuing with the explanation as to the erection of a representative wall 20, the erection of the composite windows 19C and 19D in alignment with the previously erected panel members 35D-35G may be accomplished in the same general manner as the erection of the composite window 19A, and thereafter the continued erection of the aligned panel members 35I and 35J would bring the laborers to door 16.

As depicted, the door 16 may be hung from a coupler member 30D. The use of a coupler member 30D would permit a jamb member 90 to be presented on one side for mounting the door 16 and a second jamb member 90 to be presented on the opposite side of the coupler member 30D for mounting the door 16A in living unit 12. In addition, a coupler member 30D would effect the desired structural tie between the exterior wall 20 and the common wall 23 by engaging the first panel member 35K in the common wall 23. Finally, a coupler member 30D would permit the erection of a panel member 35L that would extend outwardly of the building structure 10 in a direction opposite to the common wall 23 in order to constitute a privacy barrier between the doors 16 and 16A which provide ingress to, and egress from, the adjacent living units 11 and 12.

The tying of the oppositely directed panel members 35K and 35L as well as the oppositely directed jamb members 90, which are disposed perpendicularly with respect to the aligned panel members 35K and 35L, to the primary coupler member 30D is accomplished (by virtue of the engagement between the locking pawls 75 on the connecting flanges 70 presented from the coupler member 30D and the locking grooves 51, 52, 56 and 58 on the tongues 45 and/or 46 of the panel members 35k and 35L as well as the jamb members 90) in the same manner as heretofore described so that when the laborers slides the coupler member 30D downwardly between the opposed, aligned and modestly spaced panel members 35K and 35L (the jamb members 90 may be slid into position after the coupler member 30D is in place) all of the members so joined will be structurally tied together. It is highly likely that the coupler member 30D will also be tied to the supporting base 130, and that, of course, is accomplished by having properly anchored a reinforcing rod 136 within the supporting base 130 as the base was poured so that after the coupler member 30D is positioned the concrete 142 poured into the hollow body portion 61 of the coupler member 30D will encapsulate the reinforcing rod, as desired.

The doors 16, 16A, 18 and 31 may be fabricated in a manner similar to that employed to fabricate the window units 181. However, as depicted in FIG. 18, it is quite likely that the door 16 will preferably be swung inwardly of the living unit 11 rather than outwardly, as is the fashion generally preferred for window units 181.

To begin at the base of the door 16, a stop block is presented from the supporting base 130. Perhaps the preferable means to provide a stop block, such as 166, would be to employ a sill plate 140C secured to a supporting base 130A such as represented in FIGS. 21 and 27. However, one may employ a stop block 95 by utilizing a jamb member 90 that is, for example, received in the sill plate 140B presented from the supporting base 130B, as depicted in FIG. 18.

The bottom rail 205 (formed by a length of the closure frame 100) of the door 16 engages the stop surface 96B on the stop block 95, and an appropriate sealing strip 190 may be interposed therebetween. The top rail 206 (also formed by a length of the closure frame 100) is disposed in vertically space, parallel relation to the bottom rail 205. The lateral ends of the horizontally disposed bottom and top rails 205 and 206, respectively, are joined, as in the manner depicted in FIG. 10, to the vertically disposed left, lock stile 208 and right, hinge stile 209 (FIG. 1). The central insert 113 for the door 16 is positioned within the continuous recess 102 presented by the lengths of the closure frame 100 from which the rails 205 and 206 as well as the stiles 208 and 209 are formed. The central insert 113 for the door 16 is secured within that recess 102 by appropriate lengths of the glazing bead 110 in the same manner as the glass inserts 113 are secured within the window units 181.

The wall 207 presented from the closure frame 100 forming the top rail 206 engages the stop surface 96B on the stop block 95 presented from the jamb member 90 secured to the wall cap assembly, irrespective of whether one employs the wall cap assembly 200C depicted in FIG. 27 or the relatively uncomplicated wall cap assembly 200A or 200B depicted in FIGS. 19 or 20, respectively. Here, too, a sealing strip 190 may be interposed between the wall 207 on the top rail 206 and the stop surface 96B.

The stiles 208 and 209 would similarly engage the stop surfaces 95B presented from the jamb members 90 tied to the coupler members 30 located at either side of the door 16. The tie between a jamb member 90 and a vertically oriented coupler member 30A is well depicted in FIG. 17, and explained in relation to the use of coupler members 30A at each lateral side of the windows 19. As such, one may refer to FIG. 17, if desired, to

refresh ones recollection as to how that tie is effected, but it would appear superfluous to reiterate the complete explanation at this tim . It should also be appreciated that the tie between the jamb member 90 and the coupler member 30D is similarly effected.

At this point it should be eminently clear as to how one would erect all the exterior and interior walls of any building structure embodying the concepts of the present invention. Not only have each of the several unique structural components employed to this point been described in detail, but one or more means by which those structural components can be tied to each other, and to one or more typical supporting base configurations, have also been described in detail. The remainder of the exterior, and/or interior, walls of the exemplary structure 10, or any reasonable variation thereof, should now be able to be erected simply by employing the construction techniques described above.

It will now be recalled that there are generally two diverse approaches by which the walls themselves can be erected. The foregoing description has disclosed the direct assembly of the walls in their final, vertical disposition. It should now also be appreciated that the walls can also be assembled at ground level and then raised into their final, vertical position. With an understanding as to how the various structural components are capable of being tied together, one may readily appreciate that the same general assembly techniques can be effected with the structural components disposed in a horizontal, as well as a vertical, orientation. With reasonable lengths of the walls so assembled at ground level, several laborers can then raise the top of the wall sections so assembled into a vertical position. About the only difficulty that might be encountered would be the raising of a length of wall so that a reinforcing rod 136 extending upwardly out of the supporting base would be received within the hollow, interior of the body portion 61 on any of the primary coupler members 30 designated to receive a reinforcing rod. To obviate that potential difficulty one may simply slide the primary coupler member only partially into position. Then, after the wall has been vertically positioned, and the primary coupler member aligns with the reinforcing rod extending upwardly out of the supporting base, the laborers can continue to slide the primary coupler member downwardly over the reinforcing rod. In that way the walls can be virtually assembled in a horizontal disposition and then raised to their vertical disposition with only a modest effort required to slide selected of the primary coupler members into their final locations.

With the walls thus erected, convenience dictates that one must determine whether or not the panel members 35 afford sufficient insulation for the environment to be encountered by the building structure 10. The multitudinous, hollow cavities 211 which exist between the wall skins 38 and 39 and the plurality of transverse reinforcing ribs 40 may be sufficient in and of themselves. On the other hand, it is also quite possible that one might prefer to fill the cavities 211 with insulation to reduce thermal and/or acoustical conductivity below that provided by the material from which the structural components are fabricated. In addition, it is possible that one might prefer to provide some interior backing to the wall skins 38 and 39 of the panel members 35, or any other exposed surface, by filling the cavities 211 with some material. In any event, the cavities 211 can be conveniently filled after the walls have been erected and prior to the time that the roof 24 is raised. By way of example, one could fill the cavities with sand, a foamed plastic or even a suitable cementitious material such as an aerated concrete or a concrete utilizing an aggregate having a cellular structure such as a man-made, foamed plastic or a material found in nature, such a pumice.

After the walls have been erected one may place the electrical wiring (not shown) in the recess 175 which may extend along the top of the structural components forming the walls and then secure a suitable wall cap assembly in position atop the various exterior and interior walls. By way of an overview, the wall cap assemblies 200 should accomplish several objectives. First and foremost they should provide at least a support upon which the roof 24 can rest. Second, they should allow for some means by which to effect a structural tie between the roof and the walls (if not to the supporting base itself), as is generally required by the building codes in those jurisdictions subject to heavy winds. Finally, a preferred wall cap assembly should effect some means by which to assure the alignment of the structural components forming the walls -- particularly along those portions of the walls where lateral stability would not be inherent between the adjacent structural components. An excellent example of a situation which exemplifies potentially inherent lateral instability would be in that span of any wall within which a window, or door, exists. The structural components on either side of a window or door are not firmly tied to each other across the door, and whereas special attention can be given in an attempt to assure that those components are tied to the supporting base, it is also highly desirable that those components somehow be tied together across the span of any intervening window or door. A properly designed, and fabricated, wall cap assembly 200 will afford the necessary integrity to the overall structural design.

Three variations of a wall cap assembly 200

are depicted and described herein. With reference to FIG. 19 the cross sectional configuration of a typical wall cap assembly 200A is depicted as it passes across the top of one of those primary coupler members 30A selected to be tied to the supporting base 130. Although it is possible that the reinforcing rod 136 extending upwardly from the supporting base 130 might be of sufficient length to extend the full vertical extent of the coupler member 30A, and beyond, it is much more likely that the head 213 and a considerable length of the shank 214 of a bolt 215 would be buried within the concrete 142 encased by the body portion 61 of the primary coupler member 30A, as depicted.

The wall cap assembly 200A may comprise a metallic channel 216 the web portion 218 of which transversely spans the wall 20. Because the surfaces of all wall skins on all the panel members 35 and the exterior faces 62-65 of all the various coupler members 30 are coplanar when they are incorporated in a wall, either exterior or interior, by making the transverse span of the web portion 218 equal the transverse span between the opposite, exterior faces 63 and 65 on the coupler member 30A depicted in FIG. 19 the containing flanges 219 and 220 extending downwardly from the lateral edges of the web 218 in channel 216 will frictionally engage the wall skins on the panel members 35 as well as the exterior faces 63 and 65 on the coupler members 30. Installing a channel 216 to embrace the top of a wall along its longitudinal extent thus serves to effect the desired, lateral stabilization to the wall.

The wall cap assembly 200A also incorporates a spacer block 221 which rests upon, and extends the longitudinal length of, the web portion 218 in the channel 216. The bolt 215 which extends upwardly from the concrete 142 in the body portion 61 of the coupler portion 30A extends through a bore 222 in the web portion 218 of the channel 216 and a bore 223 in the spacer block 221 which registers with the bore 222. The bore 223 terminates in a counterbore 224 that may be of sufficient depth, and diameter, to receive a washer 225 and a nut 226 by which to secure the wall cap assembly 200A to at least selected coupler members 30. As is also depicted in FIG. 19 the roof 24 may be secured to the spacer block 221, as by a suitable adhesive 228. In this regard it should be noted that there may be a need to retain the roof 24 in proper position until such time as the adhesive "sets." On that basis it may be desirable to employ a temporary fastener, such as a small nail, or screw, 229 through the spacer block 221 and into the wall skin 38 or 39 of the panel members 35 used to form the roof 24, as will be hereinafter more fully explained.

It is also quite feasible to extend the bolt 215 upwardly through the adjacent wall skin 38 and apply the nut 226 interiorly of the panel member 35, as depicted in FIG. 22 and as subsequently explained herein in conjunction with that figure.

The wall cap assembly 200B, which is depicted in FIG. 20, may, like the vast majority of the previously described structural components, comprise an extruded thermoplastic resin which may well be fiber reinforced. The wall cap assembly also includes a channel portion 230 the web portion 231 of which transversely spans the wall 20. As previously explained in conjunction with the description of the wall cap assembly 200A, by making the transverse span of the web portion 231 equal the transverse span between the outer surfaces of the opposite, wall skins 38 and 39 on the panel members 35, the containing flanges 232 and 229 extending downwardly from the lateral edges of the web portion 233 will frictionally engage not only the wall skins 38 and 39 on the panel members 35 but also the exterior faces on the coupler members 30 employed to tie the panel members to each other. Installing a wall cap assembly 200B such that the containing flanges 232 and 233 embrace the top of a wall along its longitudinal extent thus serves to effect the desired, lateral stabilization to the wall.

The wall cap assembly 200B also incorporates a pair of longitudinally extending, laterally displaced, spacer arms 234 and 235 which extend upwardly from the lateral edges of the web portion 231 in diametrically opposite directions than the containing flanges 232 and 233. Each spacer arm 234 and 235 terminates, respectively, in a connector flange 236 and 238. As is also depicted in FIG. 19 the roof 24 may be secured to the connector flanges 236 and 238, as by a suitable adhesive 239. In this regard it should be noted that there may be a need to retain the roof 24 in proper position until such time as the adhesive "sets." On that basis it may be desirable to employ a temporary fastener, such as a small nail, or screw, 240 which extends through the connector flange 238 and into the downwardly directed wall skin 38 or 39 of the panel members 35 used to form the roof 24, as will be hereinafter more fully explained.

Although FIG. 20 represents that span of the wall which lies between the longitudinally spaced coupler members 30 so that the means for effecting a structural tie between the roof 24 and the coupler members 30 is not actually depicted in FIG. 20, it should be appreciated that a bolt 215 such as depicted in conjunction with FIGS. 19 and/or 22 could well be employed at the appropriate locations.

The wall cap assembly 200C, as depicted in FIG. 22, may, like the vast majority of the previously described structural components, also com-

prise an extruded thermoplastic resin which may well be fiber reinforced. The wall cap assembly 200C also includes a channel portion 245 the web portion 246 of which transversely spans the wall 20. As previously explained in conjunction with FIG. 19, by making the transverse span between the containing flanges 248 and 249 equal not only to the transverse span between the opposite, wall skins 38 and 39 on the panel members 35 but also the transverse span between the opposite faces 63 and 65 (or 62 and 64) on the coupler members 30, the containing flanges 248 and 249 will frictionally engage not only the wall skins 38 and 39 on the panel members 35 but also the exterior faces on the coupler members 30 employed to tie the panel members to each other. Installing a wall cap assembly 200C such that the containing flanges 248 and 249 embrace the top of a wall along its longitudinal extent thus serves to effect the desired, lateral stabilization to the wall.

The wall cap assembly 200C also incorporates a pair of longitudinally extending, laterally displaced, spacer blocks 250 and 251 which are connected to the web portion 246 by offset walls 252 and 253 that extend upwardly from the web portion 246 and then in laterally opposite directions to intersect the spacer blocks 250 and 251. The cross section defined by the web portion 246, the offset walls 252 and 253 as well as the containing flanges 248 and 249 outline engaging cavities 255A and 255B, the profile of which exactly duplicates the profile of the connecting flanges 70 presented from each of the various coupler members 30 for a purpose more fully hereinafter explained.

The upper extent of each spacer block 250 and 251 joins corresponding connector flanges 256 and 258, respectively. The connector flanges 256 and 258 are angularly disposed such that the portions which extend angularly upwardly converge, and are preferably joined, at an apex 259. Conversely, the portions of the connector flanges 256 and 258 which extend angularly downwardly past the respective spacer blocks 250 and 251 from which they are presented, diverge such that each joins with one, vertically oriented, leg of an angle brace 260 or 261, respectively. The other leg of each angle brace 260 and 261 extends horizontally and joins with the containing flanges 248 or 249 at their juncture with the respective spacer blocks 250 or 251.

As is also depicted in FIG. 22, the roof 24 may be secured to the connector flanges 256 and 258, as by a suitable adhesive 262. In this regard it should be noted that there may be a need to retain the components from which the roof 24 is assembled in proper position until such time as the adhesive "sets." On that basis it may be desirable to employ a temporary fastener, such as a small nail, or screw, 263 which extends through the connector flange 256 and into the downwardly directed wall skin 38 of the panel members 35 used to form the roof 24, as will be hereinafter more fully explained. Access to the temporary fastener may be facilitated by punching an access bore 264 through the angle brace 260 at spaced intervals along the length of the wall cap assembly 200C, as is also depicted in FIG. 22.

The wall cap assembly 200C may also be secured to the coupler member 30A, as by a bolt 215, the head 213 and a portion of the shaft 214 of which are embedded in the concrete 142 which fills the coupler member 30A. The shaft 214 extends upwardly out of the concrete 142 to penetrate: a bore 265 in the web portion 246; a bore 266 in the apex 259 of the wall cap assembly 200C; as well as, a bore 267 in the wall skin 38 of the panel member 35 of the roof 24. A beveled washer 268 is received over the shaft 214, and a nut 226 serves to tie the cap assembly 200C as ell as the roof 24 to the coupler member 30A, and thus the supporting base 130A, in a manner which should satisfy the most exacting building codes.

With the selected wall cap assembly 200 in place on the exterior walls 20 and 21 which extend generally parallel to the ridge 269 of the roof 24, the laborers may erect the structural supporting arrangement desired at the ridge 269, and any intermediate purlins (hereinafter described) deemed necessary, before assembling the roof 24. As depicted in FIG. 23, the wall cap assembly 200C is particularly suited to serve as the member upon which the roof 24 will rest at the ridge 269 of the roof 24.

The description of the arrangement employed at the ridge 269 may conveniently begin at the intersection of the interior wall 25 with the exterior, end wall 22. For privacy between adjacent bedrooms 13A and 13B it is likely that one would wish to have the wall 25 extend upward to whatever extent is required to close any gap between the top of the wall 25 and whatever roof supporting arrangement is employed. One arrangement which would effect the desired result would be to mount a wall cap assembly 200C upon the upper extremity of the panel members 35 forming the wall 25. So mounted, the containing flanges 248 and 249 on the wall cap assembly 200C would engage the opposed wall skins 38 and 39 of the panel member 35 in the same fashion as the containing flanges 248 and 249 on the wall cap assembly 200C engage the exterior faces 63 and 65 of the coupler member 30A, as depicted in, and as described in conjunction with, FIG. 22.

Along that longitudinal extent of the roof 24 which spans from the coupler member 30C (located at the juncture of the thre interior walls

25, 26 and 27) across the combined eating and living room area 15 to a coupler member 30A within the common wall 23, however, some structural reinforcement will be required to afford the necessary beam strength along that span of the ridge 269. As best represented in FIG. 24, a joist hanger 270 may be secured from the top of the coupler member 30C. The anchor flange 271 on the joist hanger 270 extends horizontally across the top of the coupler member 30C, and the shaft 214 of bolt 215 extends upwardly through the bore 272 in the anchor flange 271 to receive a nut 226 (not shown in FIG. 24, but depicted in FIG. 22). A stirrup 273 extends downwardly from the anchor flange 271 for a distance substantially equal to at least the lateral dimension of a panel member 35 less the lateral dimension of the tongue 45. This configuration would allow the tongue 45 to extend upwardly above the level of the anchor flange 271 on the joist hanger 270. As shown, the upper surface of the anchor flange 271 should preferably lie in the same plane as the positioning shoulders 41A and 41B. With the panel member 35 so disposed, the tongue 46 rests upon the horizontal supporting foot 274 of the joist hanger 270.

One may, of course, allow the tongue 46 to constitute the exposed underside of the beam formed by the panel member 35 which spans across the combined eating and living room area 15. It is, however, also possible that one would prefer to provide a geometrically cleaner appearance to the underside of the beam spanning the combined eating and living room area 15, and in that situation one could support a terminating coupler member 275 from the tongue 46.

The terminating member 275 can be fabricated in the same manner as the primary coupler member 30A, except that the connecting flanges 70B would be eliminated from the terminating member 275. As such, the connector flanges 70A on the terminating member 275 would operatively engage the tongue 46 on the panel member 35 supported in the stirrup 273. That is, the locking pawls 75A and 75B on the connecting flanges 70A would be received within the locking grooves 56 and 58, respectively, of the tongue 46. The hollow body portion 61 of terminating member 275 would serve as an excellent race within which to receive the electrical wiring, and the unobstructed, rectilinear, exterior faces 63, 64 and 65 on the body portion 61 would provide a clean finish to the lower edge portion of the composite beam formed from the panel member 35.

Even though one might choose to employ a terminating coupler member 275 on the underside of the panel member 35 when the latter is serving as a beam, one still has the choice of resting the tongue 46 on the supporting foot 274 of stirrup 273 or resting the terminating coupler member 275 on the supporting foot 274. Should one elect to rest the tongue 46 of the panel member 35 on the supporting foot 274, even when a terminating coupler member 275 is supported therefrom, the depth of the joist hanger 275 would not be changed. One would, however, elect to remove that length of the connecting flanges 70A which would preclude the body portion 61 of the terminating coupler member 275 from engaging the exterior face 65 on the coupler member 30C from which the joist hanger 270 is supported. This arrangement is depicted in FIG. 24, and it will be observed that the connecting flanges 70A terminate the juncture with the side plates 276 of the joist hanger.

It is also possible that one might prefer to have the terminating coupler member 275 rest directly upon the supporting foot 274 of the stirrup 273 in the joist hanger 270. That choice would require only that the depth of the stirrup 273 be extended to include the depth of the body portion 61 of the terminating coupler member 275.

In either situation, the panel member 35 spans across the combined eating and living room area 15 to be received, in the manner desired, in the stirrup 273 of a second joist hanger 270 supported from the coupler member 30 in the common wall 23.

The configuration of the panel member 35 is such that it affords not only excellent bending strength but also rather good columnar strength along its longitudinal axis. However, it must be understood that the configuration of the panel member 35 affords rather poor strength against relatively high compressive loading (on the order of what one might expect to encounter from any substantial roof loading) in a direction laterally of the panel member 35 itself. As a result, it is considered highly desirable, if not absolutely necessary, that at least the end openings of the cavities 211, which extend longitudinally within the panel member 35, be plugged to impart the additional strength required to prevent the longitudinal ends of the panel member 35 -- which rests upon the coupler members 30 serving as the beam supports -- from buckling when employed as a simple beam.

Specifically, the panel member 35 must be reinforced to accept the stresses imparted to the ends thereof as a result of the distribution of forces required to effect a transfer of the load carried by the panel member 35 acting as a beam (across the span of the combined eating and living room area 15) into the columnar support provided by the coupler members 30 from which the joist hangers 270 are carried. The necessary plugging can be effected by the simple wooden plugs 278 inserted within the ends of the cavities 211, as depicted in FIG.

24. Should the terminating coupler member 275 rest directly upon the supporting foot 274 of the joist hanger 270, it is recommended that consideration be given as to whether the hollow body portion 61 of the terminating coupler member 275 should also be plugged. Such calculations are well within the skill of the engineers who will be determining the details for a given environment and need not be discussed to any greater extent herein.

With the panel member 35 thus supported as a simple beam which extends between the joist hangers 270, the connecting flanges 70A on a secondary coupler member 30E can, as best seen from FIG. 23, operatively engage the tongue 45 at the uppermost edge of the panel member 35. As has been previously described in considerable detail, operative engagement of the connecting flanges 70A with the tongue 45 requires that the locking pawls 75A and 75B on the connecting flanges 70A are received within the locking grooves 51 and 52, respectively, of the tongue 45 on the panel member 35.

The connecting flanges 70B on the secondary coupler member 30E are operatively received within the engaging cavities 255 in the wall cap assembly 200C to effect a structural tie therebetween. As is also depicted in FIG. 23, the cross sectional profile of the extension arm 71C, including the locking pawl 75C presented therefrom, is sufficiently congruent with the cross sectional profile of the engaging cavity 255A, and the cross sectional profile of the extension arm 71D, including the cross sectional profile of the locking pawl 75D presented therefrom, is sufficiently congruent with the cross sectional profile of the engaging cavity 255B, that the wall cap assembly 200C can easily slide relative to the secondary coupler member 30E, as necessary to effect an operative engagement therebetween.

In some environments the roof 24 can be sufficiently supported between the ridge 269 and the parallel exterior walls 20 and 21. In those situations the roof may be assembled as soon as the roof supporting arrangement is assembled at the ridge 269. With continued reference to FIGS. 1, 22 and 23, a pair of panel members 35 are rested upon the connector flange 256 presented upon the wall cap assembly 200C secured to the top of the exterior wall 20. The pair of panel members 35 are then manipulated until they are disposed, as desired, to span between that wall cap assembly 200C on an exterior wall and a second wall cap assembly 200C located at the ridge 269 of the roof 24.

Were the wall cap assembly 200A secured to the wall 20, the panel members 35 would be rested upon the spacer block 221 (as depicted in FIG. 19), and were the wall cap assembly 200B secured to the wall 20, the panel members 35 would be rested upon the connector flanges 236 and 238 (as depicted in FIG. 20).

In any event, when two wall panel members 35 are thus supported between a wall cap assembly 200 on an exterior wall and th supporting arrangement employed at the ridge 269 of the roof 24, the laborers may slide a coupler member 30 therebetween operatively to engage the two panel members so positioned. Typically, one would tie the successive panel members 35 forming the roof 24 with secondary coupler members 30E, as depicted in, and as described in conjunction with, FIG. 16. The roof 24 is thus assembled by sequentially positioning successive panel members 35 along the longitudinal extent of the two sloping sides 24A and 24B of the roof 24 and by tying the successive panel members to each other with the appropriate coupler members 30 as well as by tying the panel members 35 to the wall cap assemblies 200 in the manner heretofore described in conjunction with the description of the several variations for the wall cap assemblies 200 disclosed.

With the panel members 35 forming the two slopes 24A and 24B of the roof 24 tied in place as depicted in FIG. 23 the ridge cap member 280 may be installed. The ridge cap member 280 has a pair of mounting tabs 281A and 28IB which engage the wall skins 39 of the panel members 35 forming the opposed slopes 24A and 24B, respectively of the roof 24, and they may be secured thereto by fastener means such as screws, rivets or adhesive 282.

The cross sectional profile of the ridge cap member 280 may be virtually any shape desired, but the miniature parroting of the roof line depicted is quite functional. That is, the peaked upper walls 283A and 283B shed water, and the horizontally disposed laterally extending walls 284A and 284B may be pierced, as desired, with a plurality of apertures 285 which accommodate any desired ventilation.

It was previously mentioned that one may employ purlins to provide any intermediate support to the span of each slope 24A or 24B forming the roof 24. A typical arrangement by which to support a metallic purlin 290 is best represented in FIGS. 25 and 26.

To assure a suitable columnar bearing for the ends of the purlin 290 the coupler members 30 selected to support at least the opposite ends of the purlin 290 should preferably be tied to the supporting base 130 in a manner hereinbefore described. The hollow interior of the body portion 6I for that coupler member 30 should be filled with concrete 142 up to a level such that the support flange 291 on purlin 290 can rest upon the con-

crete 142 within the coupler member 30. Additional bearing support can also b provided by employing a coupler member 30C in lieu of the coupler member 30A which might normally be employed at the location where a purlin 290 would be placed. By employing a coupler memb r 30C a jamb member 90 may, as depicted in FIGS. 25 and 26, extend upwardly beneath the purlin 290 and terminate at preferably the same level as the concrete 142 within the coupler member 30C. In addition to providing an additional support area upon which the purlin 290 can rest, the presence of the jamb member 90 increases the L/R ratio of the combination in order to provide the most effective columnar arrangement for supporting the ends of the purlin 290.

Assuming that one would elect to support the purlin 290 from a coupler member 30C, the exterior face 63 would be notched, as at 292, to receive the end of the purlin 290. The support flange 291 will include not only the horizontal portion 293 which rests upon the supporting surface but also a vertically oriented, return portion 294 which contributes to the strength of the support flange 291 to resist bending moments. The purlin 290 also includes a web portion 295 which affords the primary measure of the beam depth. Finally, the purlin 290 preferably also presents a connector flange 296 which is angularly disposed to conform to the pitch of the roof sides 24A or 24B, as best depicted in FIG. 26, to engage the wall skins 38 of the panel members 35 used to assemble the roof 24. Here, too, the wall skins 38 may be preferably secured to the connector flange 296, as by any suitable means such as adhesive 262, and even an interim fastener, such as the screw 298, may be employed to allow the adhesive 262 the required span of time within which to "set."

The choice as to whether or not to employ purlins will be dependent upon the roof loading expected to be encountered in the environment where the building structure 10 is to be erected and also upon the span between the exterior walls and the ridge 269. It should, however, also be now apparent that one could, as well employ purlins 290 on either side of the ridge 269 to serve as the principal support for the ridge 269. Such choices can well be made by those who design the building structure for a particular use and/or environment and are not considered to be limitations on the concepts of the present invention.

The foregoing disclosure has included several alternative configurations for various structural components, and as such, there are a wide variety of choices for the specific combinations of structural components that can be incorporated in any given building structure 10. It should be understood that the decision as to which configuration for each structural component to be used will be made by the designers, architects and/or engineers, off-site and prior to the time that the structural components are shipped to th construction site. However, once the selection is made, for whatever considerations, as to which specific configuration is desired for each structural component that will be employed in a particular building project, the structural components so selected can be supplied to the building site in kit form for erection by virtually unskilled laborers under the supervision of a minimal number of knowledgeable foremen.

As should now be apparent, the present invention not only teaches that a building can be constructed virtually in its entirety from a plurality of standardized, mass produced, structural components by relatively unskilled laborers without specialized tools in a far shorter period of time than a comparable structure can be constructed from prior known components but also that the other objects of the invention can likewise be accomplished.

Claims

1. Structural components for a modular building to be erected upon a supporting base, said structural components comprising:
a plurality of load bearing coupler members to be disposed in spaced intervals along the locus of points defining walls of a modular building, said coupler members to oriented substantially vertically with respect to the supporting base;
means selectively to secure said coupler members to the supporting base;
a plurality of panel members; and,
means structurally to tie said panel members to said coupler members.

2. Structural components for a modular building, as set forth in claim 1, wherein said means structurally to tie said panel members to said coupler members further comprises:
at least one pair of transversely spaced, parallel connecting flanges presented from said coupler members;
oppositely directed, lateral edges on side panel members;
tongue means presented from at least one of said lateral edges on said panel member; and,
said connecting flanges operatively engaging said tongue means selectively to tie said panel members to said coupler members.

3. Structural components for a modular building, as set forth in claim 2, wherein said means structurally to tie said panel members to said coupler members further comprises:
at least one pair of transversely spaced, parallel connecting flanges presented from each said cou-

pler member; and,
at least one pair of locking grooves recessed into said tongue means;
means presented from said connecting flanges cooperatively to engage said locking grooves selectively to tie said panel members to said coupler members.

4. A structural member for engaging and supporting a roof in a modular building structure, said structural member comprising:
a pair of laterally spaced, generally vertically oriented, spacer blocks having upper and lower portions;
web means extending generally horizontally between the lower portions of said spacer blocks;
containing flanges extending downwardly from the lower portions of said spacer blocks; and,
connector flanges attached to, and oriented substantially transversely of, the upper portions of said spacer blocks to support the roof.

5. A modular building structure comprising:
a supporting base extending along the locus of points which define at least the exterior walls of the building structure;
a plurality of load bearing coupler members disposed at spaced intervals along said supporting base, said coupler members being oriented substantially vertically with respesct to said supporting base;
means selectively to secure at last selected coupler members to said supporting base;
a plurality of vertically oriented panel members interposed between said spaced coupler members to form the walls; and,
means structurally to tie said panel members to said coupler members.

6. A modular building structure, as set forth in claim 5, wherein:
one or more anchor means are secured to said supporting base and extend upwardly therefrom; and,
means are provided operatively to engage said anchor means and thereby secure at least selected load bearing coupler members to said supporting base.

7. A modular building structure, as set forth in claim 5, further comprising:
a sill plate;
said sill plate interposed between said supporting base and said panel members as well as at least selected of said load bearing coupler members;
means to secure said sill plate to said supporting base.

8. A method for the construction of a building from a plurality of prefabricated components comprising the steps of:
providing a supporting base;
positioning a panel member adjacent another panel member;
sliding a coupler member between the positioned panel members and into interlocking engagement therewith;
sequentially adding panel members and coupler members by repeating said steps of positioning and sliding to form interior and exterior walls of the desired building structure.

9. A method of the construction of a building from a plurality of prefabricated components, as set forth in claim 8, comprising the further step of:
joining the top edges of the panel members and coupler members along the interior and exterior walls with wall cap assemblies.

10. A method for the construction of a building from a plurality of prefabricated components, as set forth in claim 9, comprising the further step of:
affixing a roof to the wall cap assemblies.

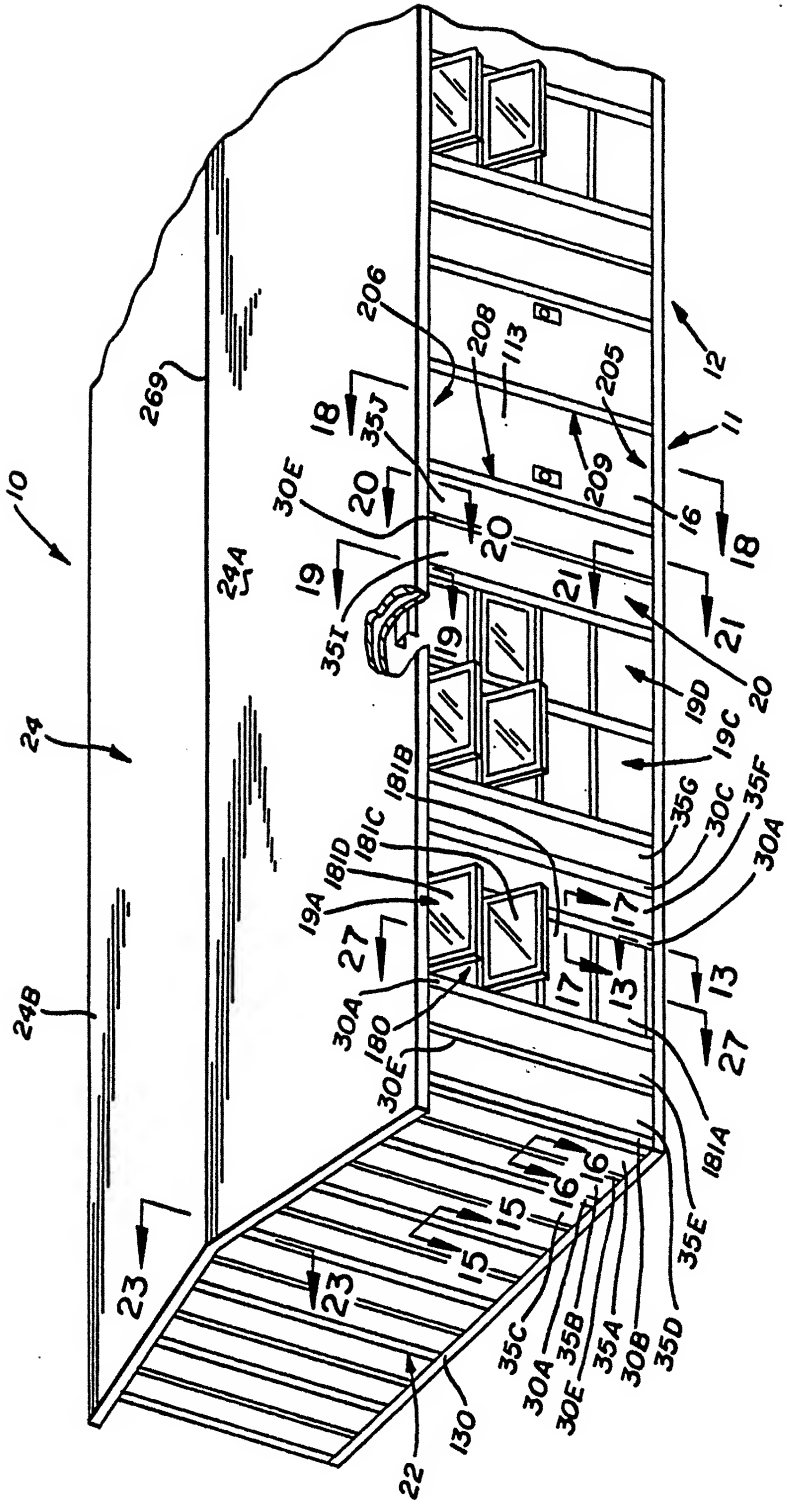
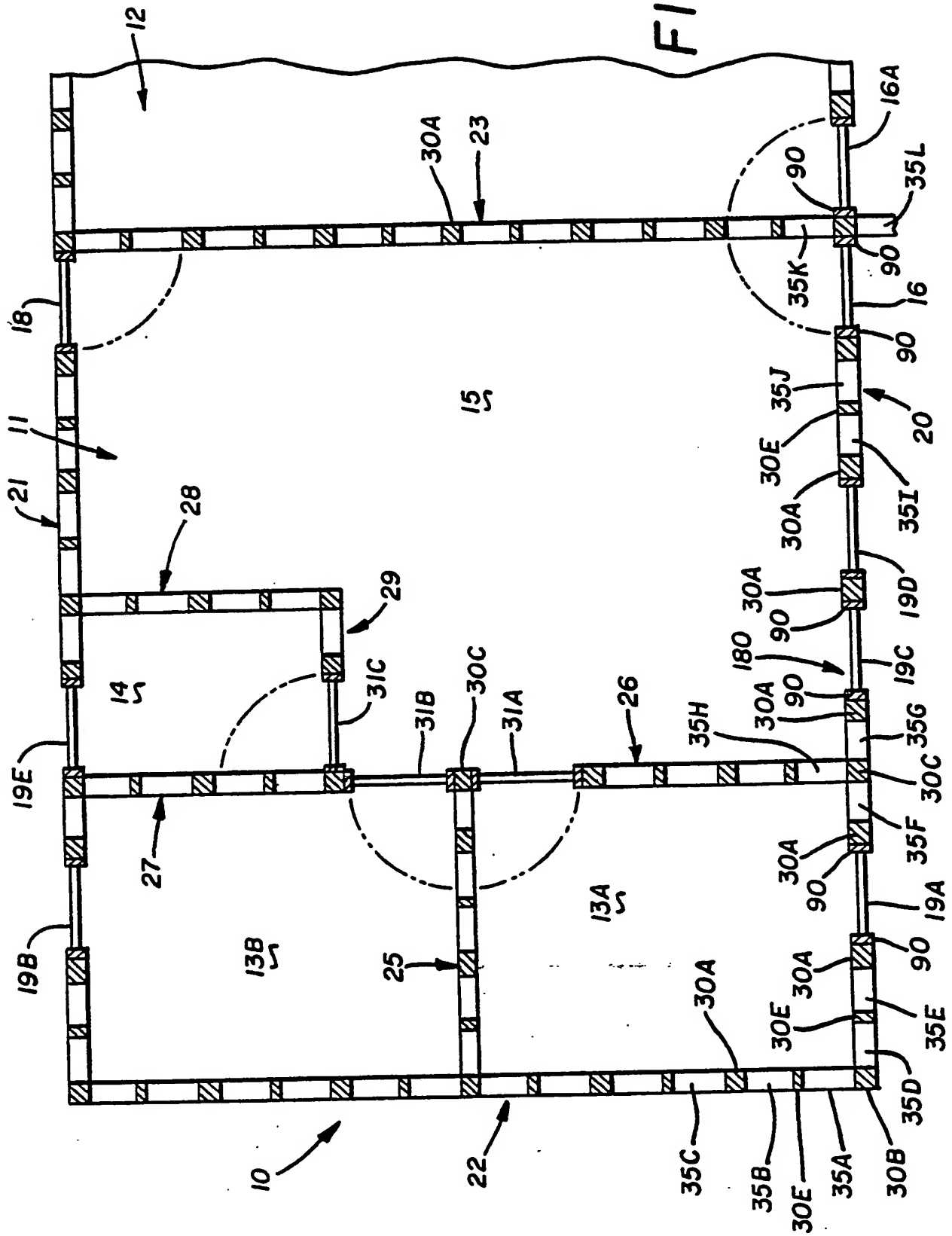


FIG. 1

FIG.2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16A
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35L
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35J
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28
30A
19D
29
90
180
19C
14
31C
30C
26
30A
35G
31B
31A
35H
90
19E
30C
35F
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30A
90
19A
13A
19B
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35D
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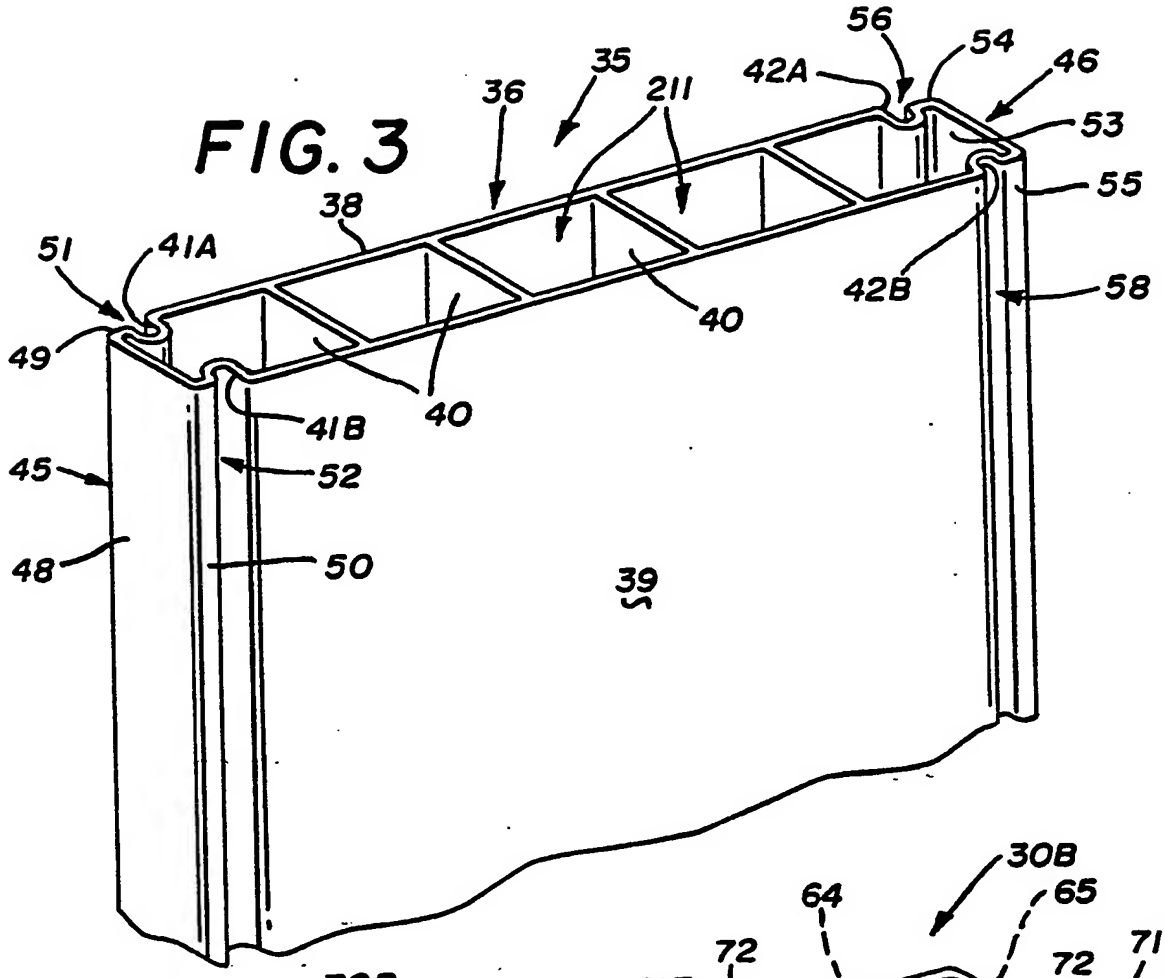
35A
30B

FIG. 3



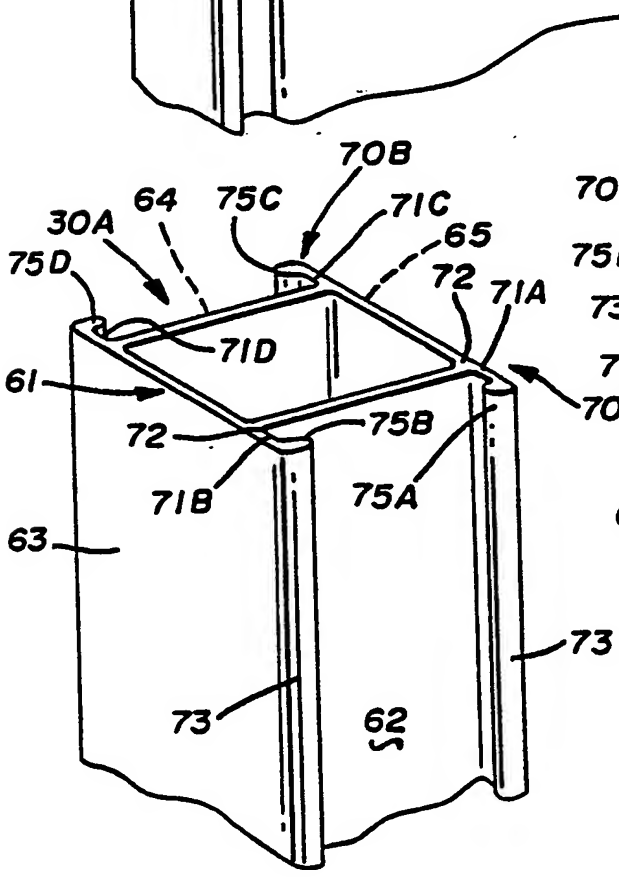


FIG. 4

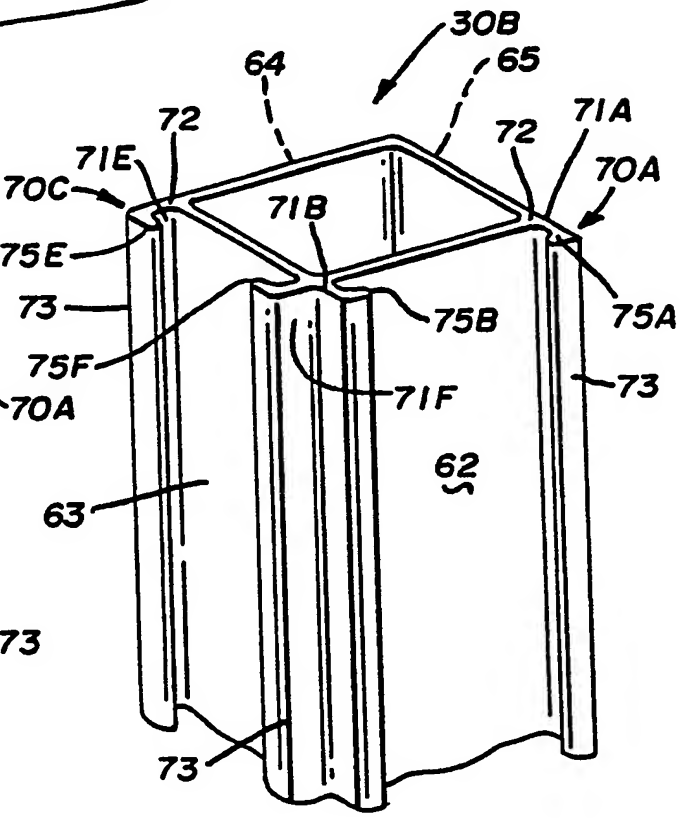


FIG. 5

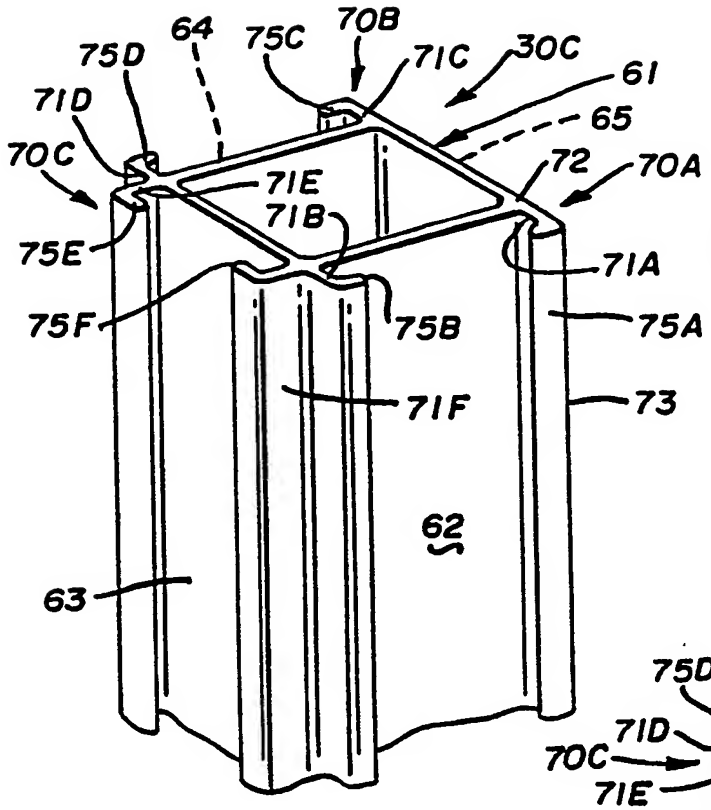
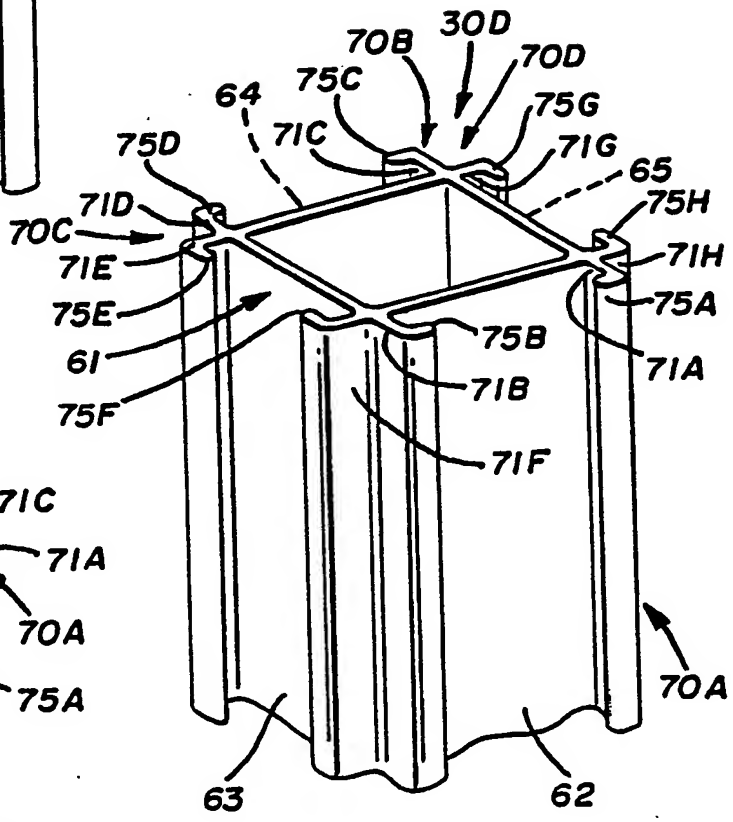


FIG. 6



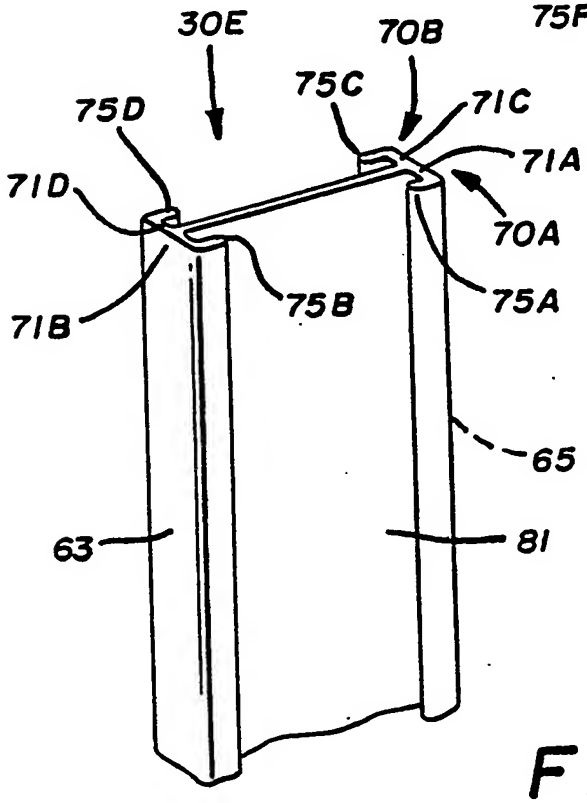
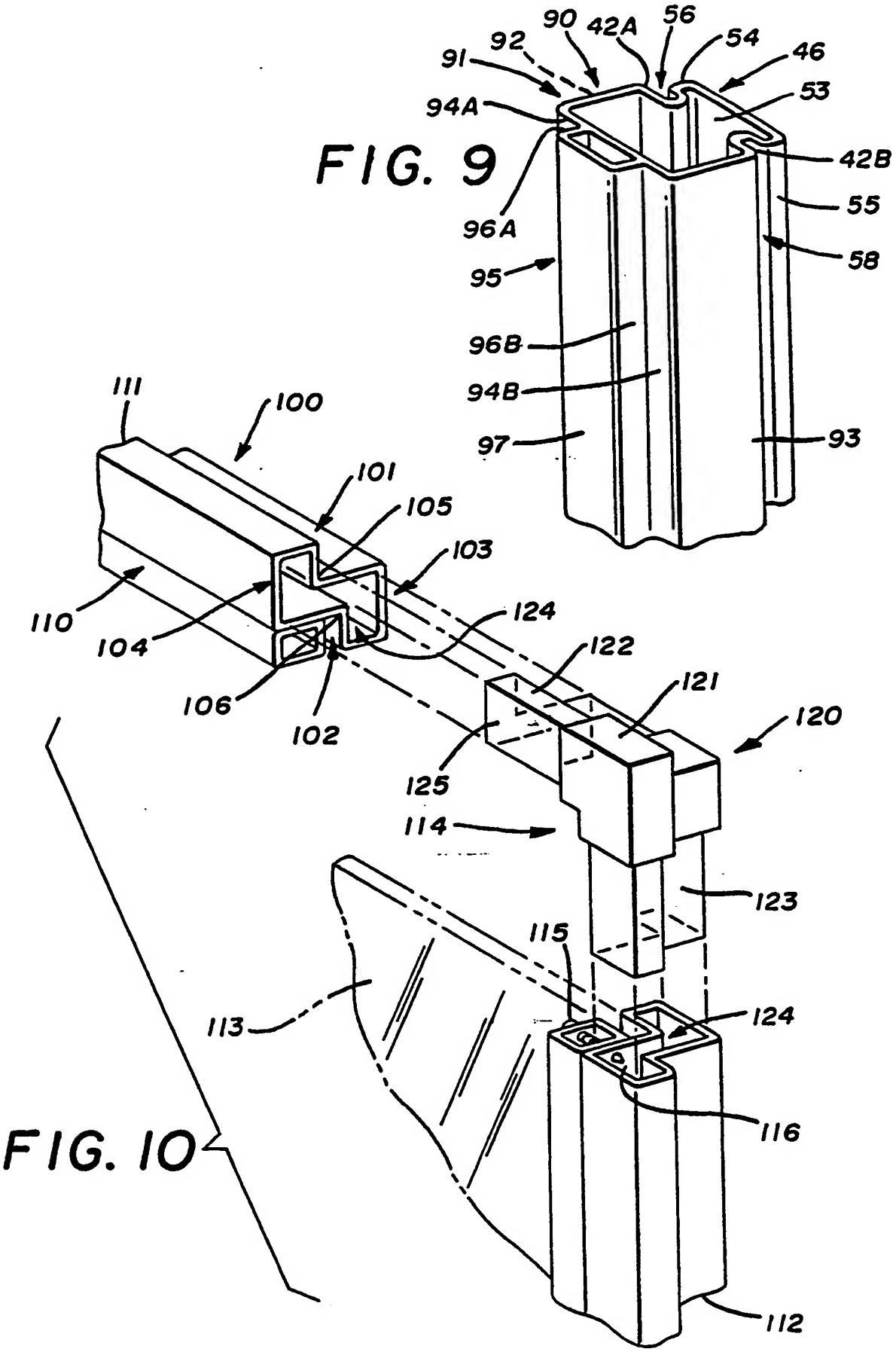


FIG. 7

FIG. 8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42A
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96A
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96B
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FIG. 9

FIG. 10

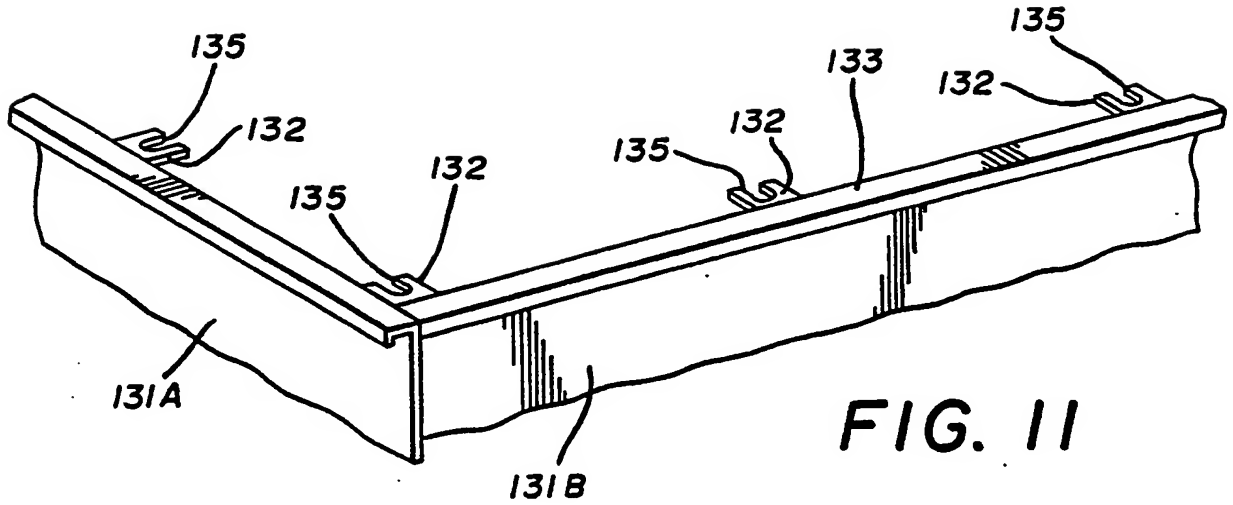
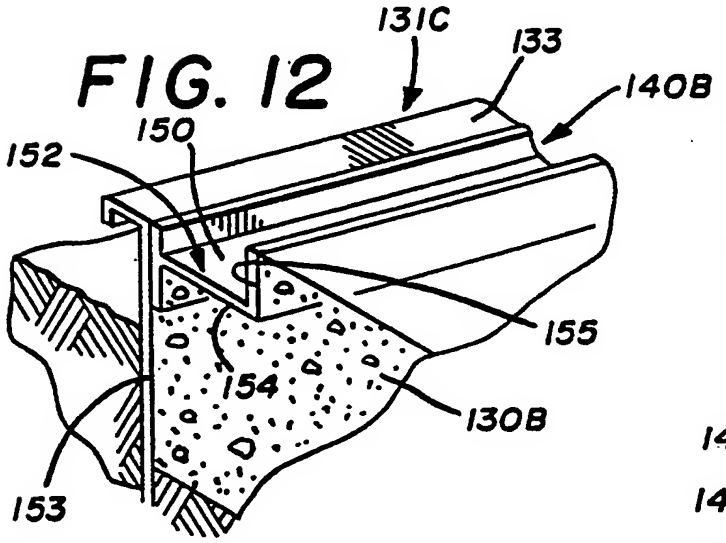


FIG. 11

FIG. 12



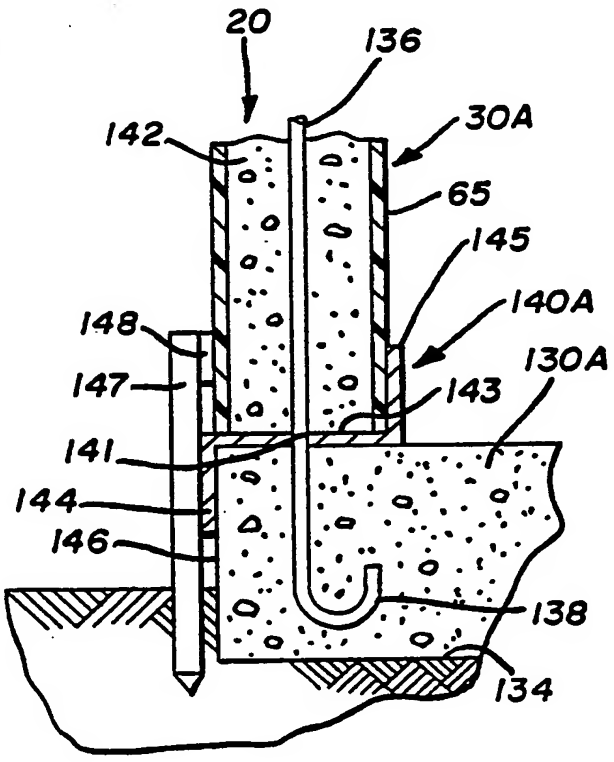


FIG. 13

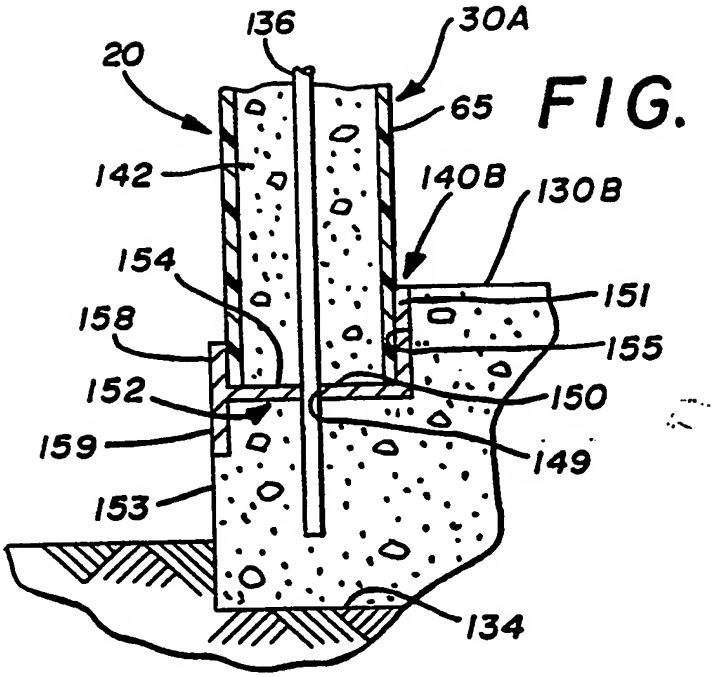


FIG. 14

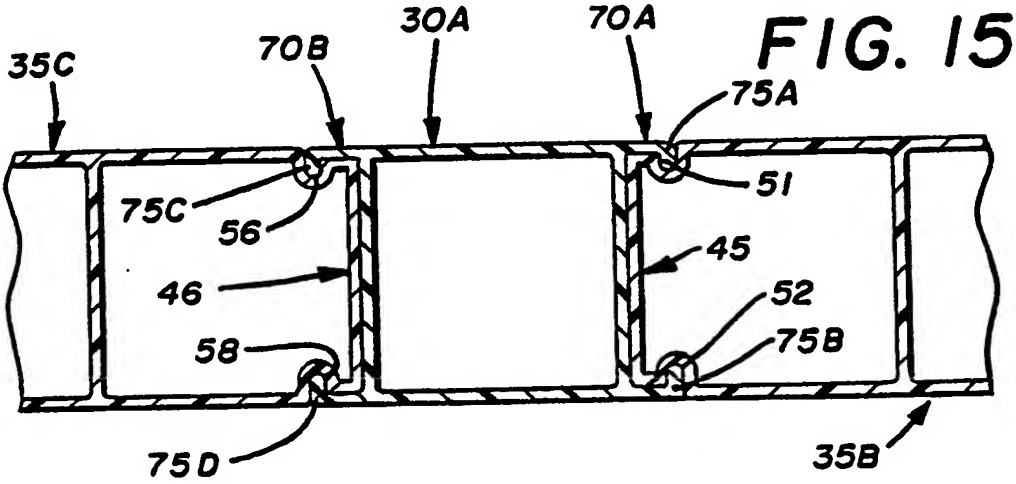


FIG. 15

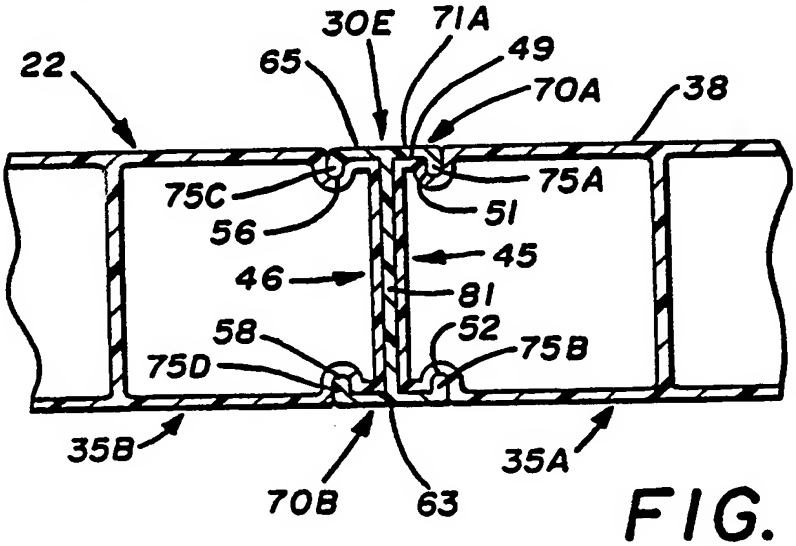


FIG. 16

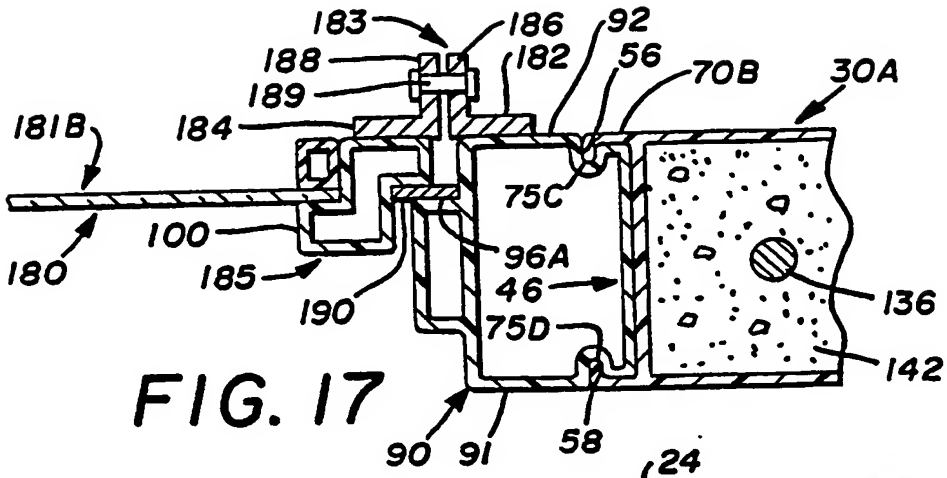


FIG. 17

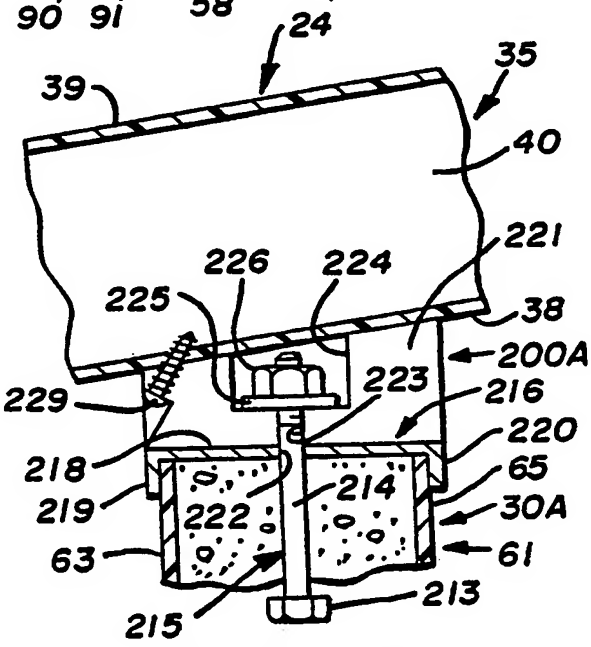


FIG. 19

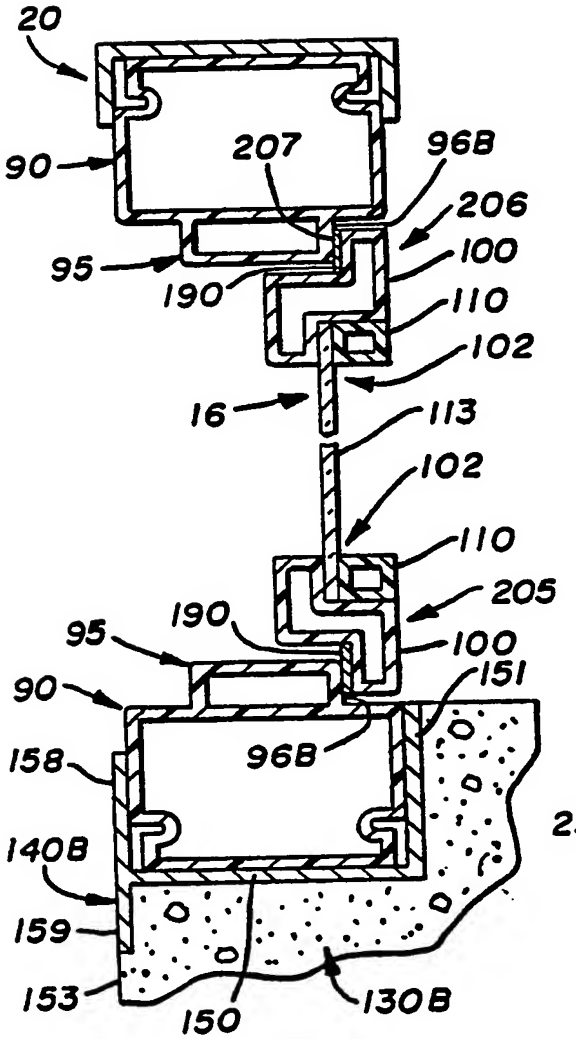


FIG. 18

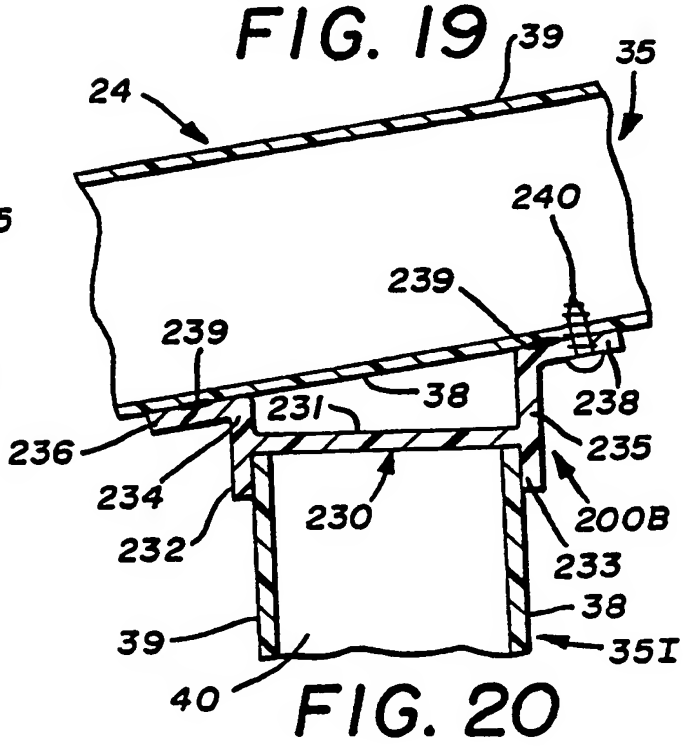


FIG. 20

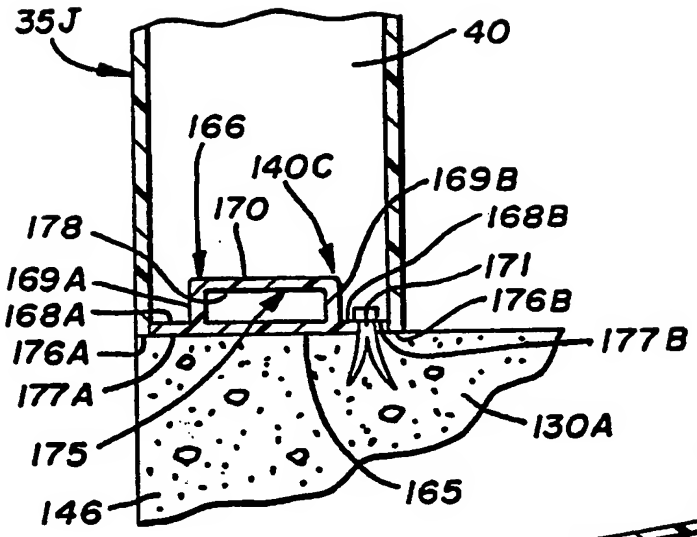
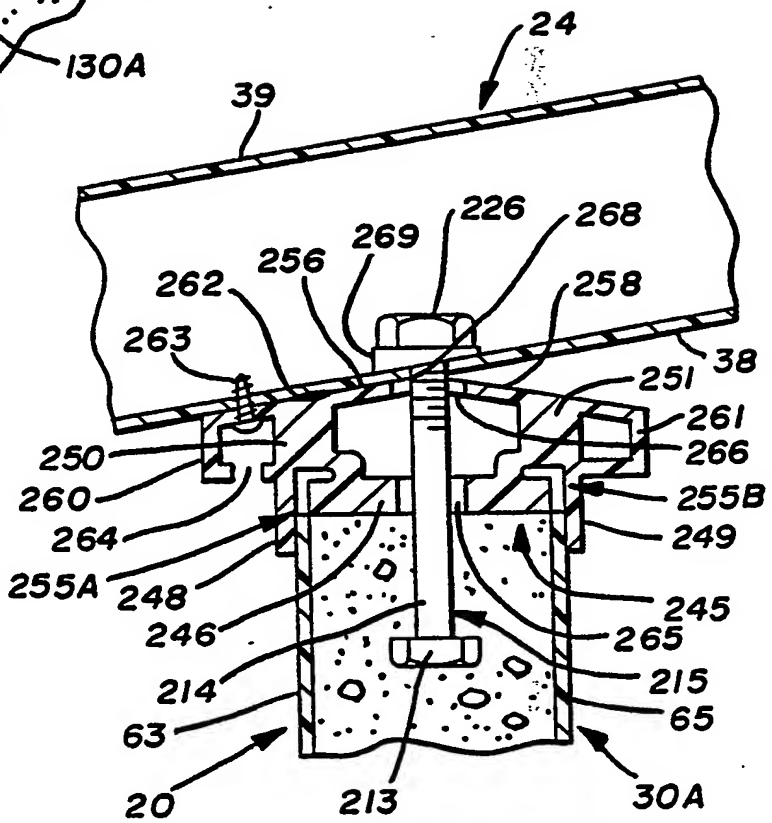

35J
40
166
140C
169B
170
168B
178
171
169A
176B
168A
177B
176A
177A
130A
175
165
146

FIG. 21


24
39
226
268
269
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262
258
263
38
251
261
250
266
260
255B
264
249
255A
248
245
246
265
214
215
63
65
20
213
30A

FIG. 22

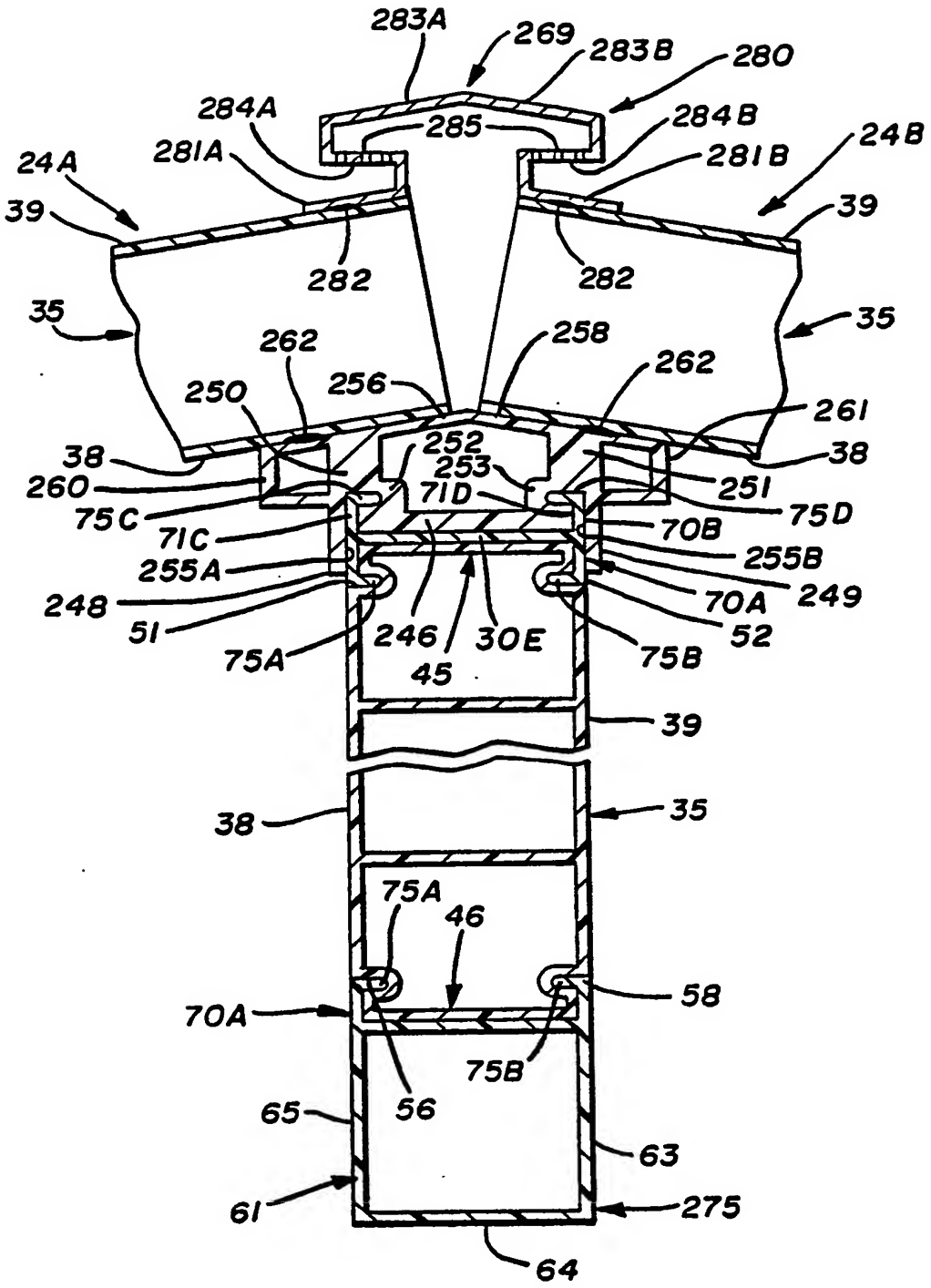


FIG. 23

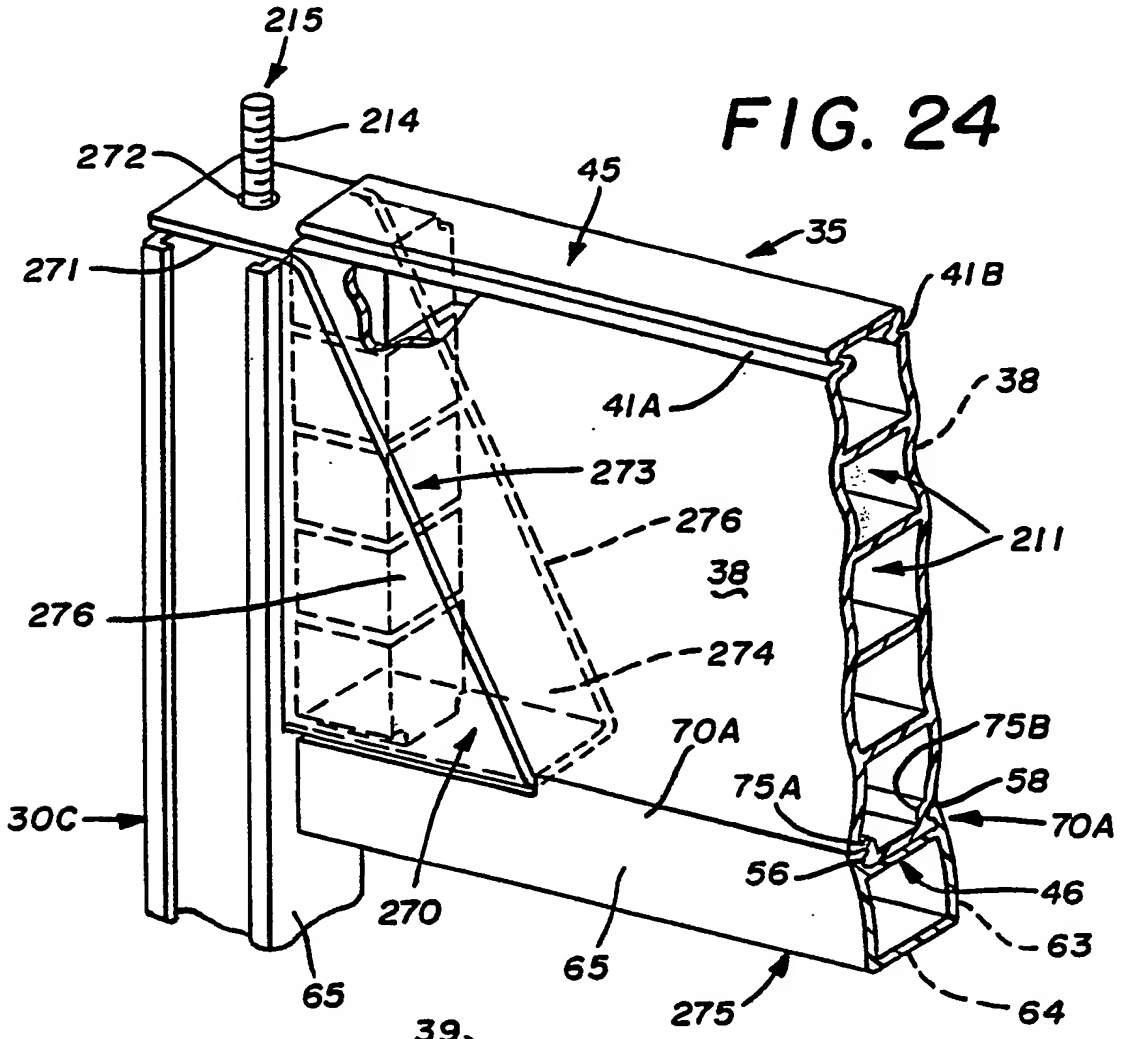


FIG. 24

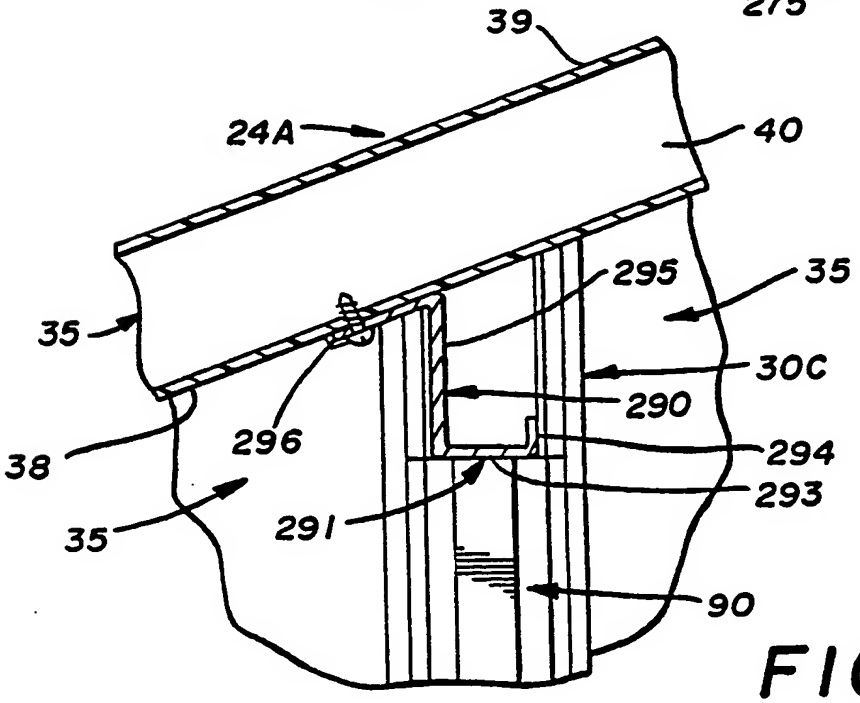


FIG. 26

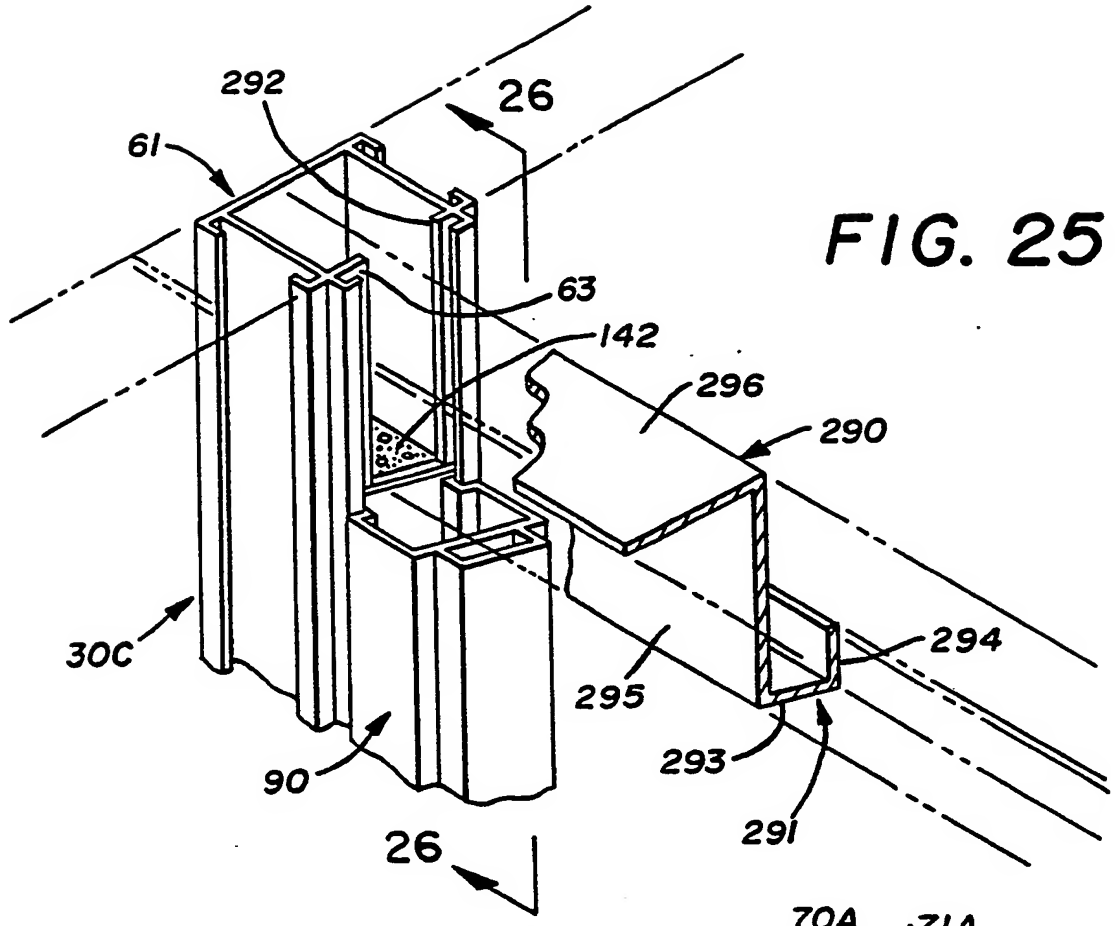

292
26
61
63
142
296
290
30C
294
295
90
293
291
26

FIG. 25

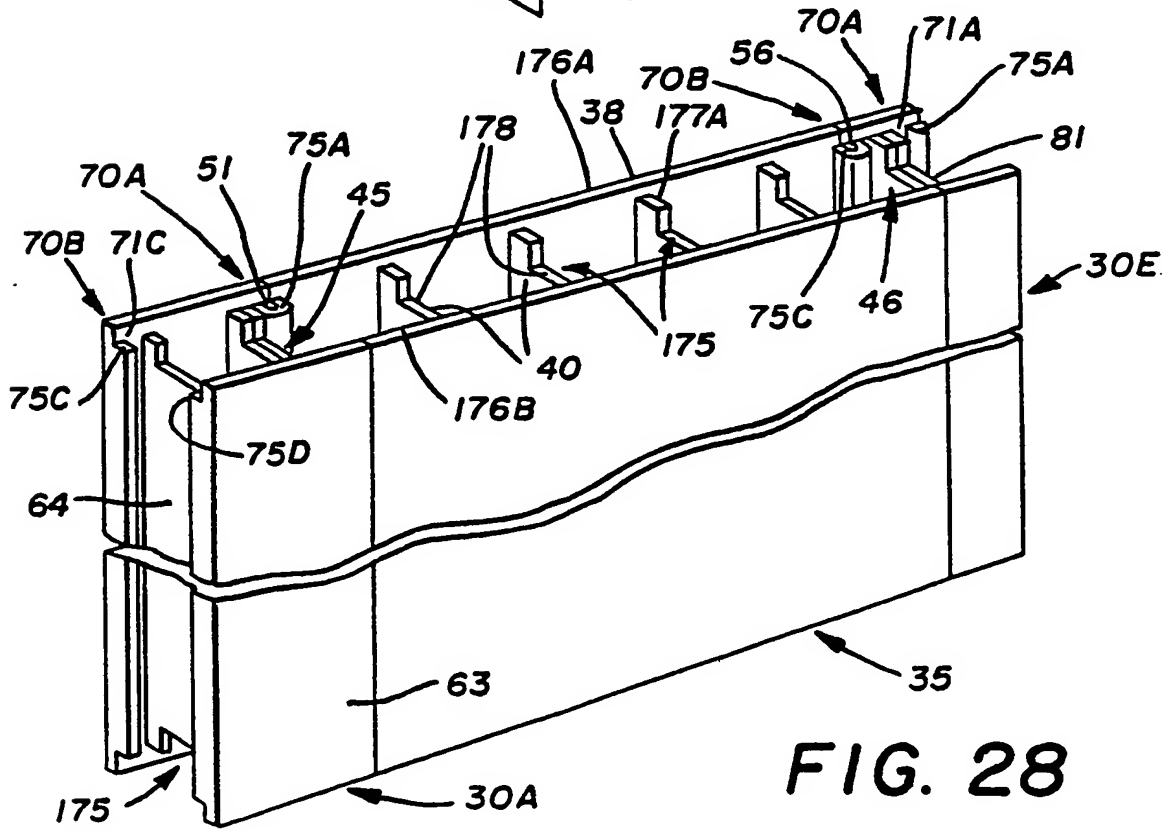
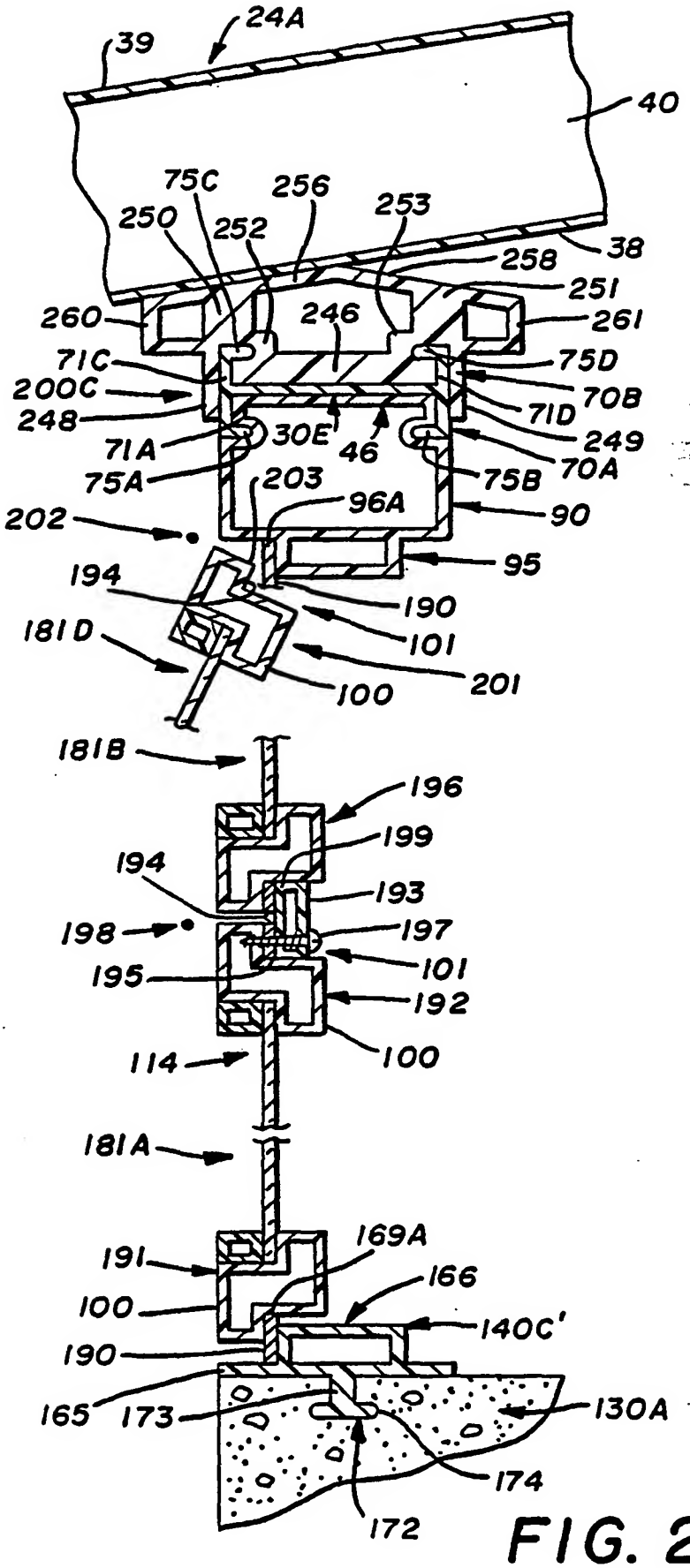

70A
71A
56
176A
70B
75A
38
177A
178
81
75A
70A
51
45
70B
71C
30E
75C
46
175
40
176B
75D
64
63
35
175
30A

FIG. 28


24A
39
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75C
256
253
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252
38
258
251
260
246
261
71C
75D
200C
70B
71D
248
249
71A
30E
46
70A
75A
203
75B
96A
202
90
95
194
190
181D
101
201
100
181B
196
199
194
193
198
197
101
195
192
100
114
181A
169A
191
166
100
140C'
190
165
173
130A
174
172

FIG. 27

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 12 0314

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-3 657 849 (GARTON) * Column 2, lines 38-75; column 3, lines 1-75; column 4, lines 1-57; figures 1-3 *	1	E 04 B 2/72 E 04 B 1/00
A	---	5-8	
A	US-A-2 143 288 (STOLZ) * Page 1, column 1, lines 30-60; column 2, lines 1-54; figures 1,2 *	2,3	
A	---		
A	GB-A-2 191 225 (PORTAKABIN) * Page 2, lines 29-130; page 3, lines 1-34; figures 1,2 *	6,5	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 04 B
E 04 H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20-03-1989	SCHOLS W.L.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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